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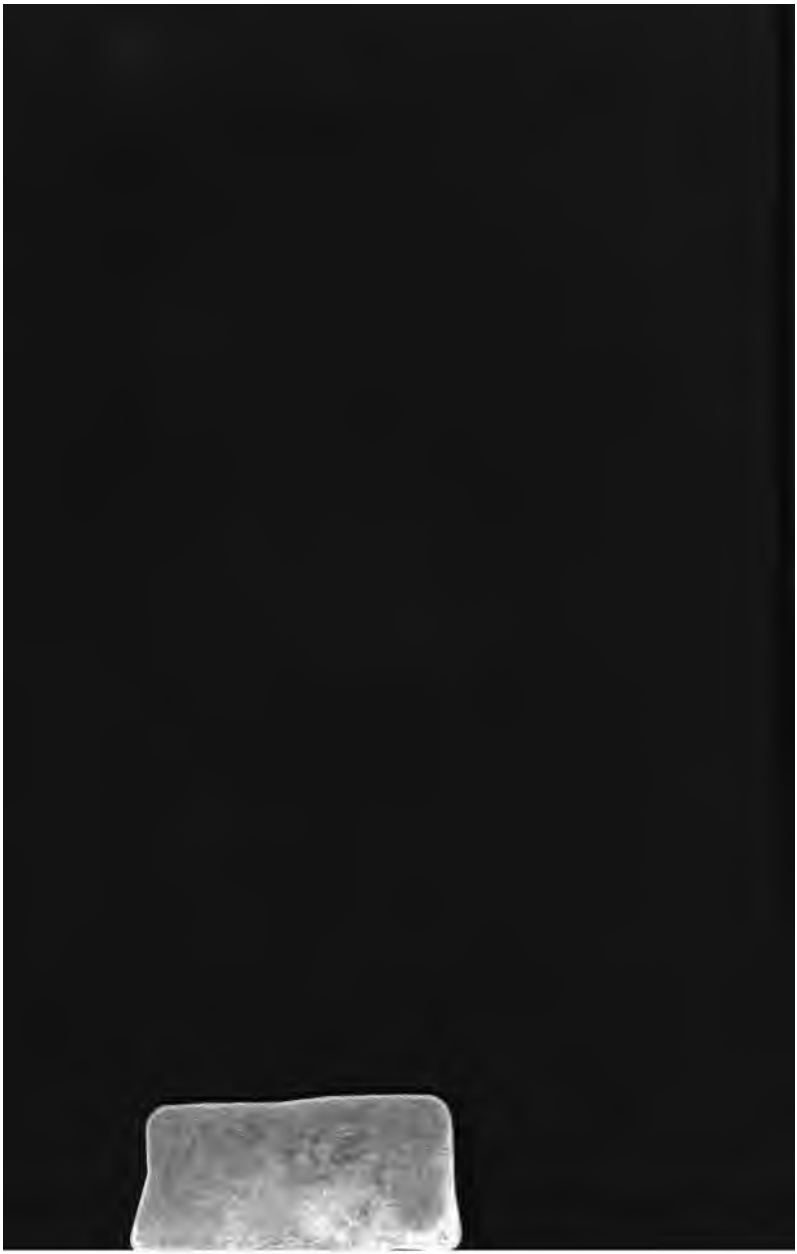

WONDERS OF THE PLANT-WORLD.

A FOREST IN MADAGASCAR

Page 151

WONDERS

OF

THE PLANT-WORLD:

OR,

CURIOSITIES OF VEGETABLE LIFE,

AND NOTICES OF REMARKABLE PLANTS, TREES, AND FLOWERS.

BIBLIOTHECA BODL

"If thou art worn and hard beset
With sorrows that thou wouldst forget,
If thou wouldst read a lesson that will keep
Thy heart from fainting and thy soul from sleep,
Go to the woods."

LONGFELLOW.

LONDON:
T. NELSON AND SONS, PATERNOSTER ROW;
EDINBURGH; AND NEW YORK.

1870.

191. k. 50.

PREFACE.

AN old botanist very justly says, "Among the manifold creatures of God that have all, in all ages, diversely entertained many excellent wits, and drawn them to the contemplation of the divine wisdom, none have provoked men's studies more, or satisfied their desires so much, as plants have done, and that upon just and worthy causes; for what greater delight is there than to behold the Earth apparelled with plants as with a robe of embroidered velvet, set with orient pearls, and garnished with great diversity of rare and costly jewels? But the principal delight is in the mind, singularly enriched with the knowledge of these visible things, setting forth to us the invisible wisdom and admirable workmanship of Almighty God."

Yet fascinating as is this study, and well adapted as it is to refine the taste, and to occupy in an entertaining and

useful fashion the leisure of the student, it cannot be said to receive in Great Britain the attention to which it is entitled. Botany is assuredly one of the least popular of the sciences. Something of this may be due to the forbidding character of the technology which meets the scholar on the very threshold. The first pages of a treatise or manual of botany are no very pleasant reading for youthful readers, and it is to be feared that many are debarred from going further by their portentous aspect. Yet the study is so easily pursued—its appliances and instruments are so simple, its literature is so readily comprehended—that it needs but to be better known to be more generally cultivated. The botanist does not require any extensive library or colossal museum. The nearest field, or hedge-row, or brook-side—the garden, or the coppice—the running stream, or the marshy pool—offers him a book whose pages are full of interest, and from which he may transfer to his herbarium such specimens as may be necessary for after-consultation. It is a study for in-doors and out-of-doors, for winter as well as spring, for the mountain district or the sea-side. It may be pursued at all times and in all places, and is within the reach of the poor no less than of the wealthy.

The object of the present volume is to bring before the reader, in a small compass, some of the most attractive features of botanical study, to show wherein its admirable

interest lies; to illustrate its general value and particular uses. It is hoped that by this means the young reader may be induced to apply himself to its scientific acquisition, and, from a knowledge of special plants and flowers, be led to a knowledge of their mutual relations, their likenesses, and their differences. Technical terms have been very sparingly introduced, and never without an explanation. In the preliminary chapters various illustrations have been brought together of the properties, organization, and peculiarities of the Leaf, the Blossom, and the Root; and it is believed that enough has been said upon these points to stimulate the imagination of the youthful student. The bulk of the volume is necessarily devoted to what, in a more limited sense, are generally understood to be the *Wonders* of the Plant-World; but a considerable space has also been allotted to a consideration of those members of the Vegetable Kingdom which minister to the wants or luxuries of man.

November 1869

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WONDERS OF THE PLANT-WORLD.

I.—WONDER-LAND.

"They are flown,
Beautiful fictions of our fathers, wove
In Superstition's web when Time was young."

ONCE upon a time you would never meet with boy or girl—seldom with man or woman—who had not a liking for the old faëry tales, for the old legends of giants and dwarfs, enchanted castles, enchanted swords, magicians, ondines, fays, elves, and gnomes, and the other wonders of Wonder-Land. To the dwellers among the commonplaces of every-day life there seemed a peculiar attraction in the elements of the marvellous. They never grew weary of tales about magic caverns, whose entrances are only revealed to seekers provided with some mysterious talisman, and which, when opened up, are found to be full of the most gorgeous treasures of gold and silver and precious stones. About magic horns "in

Elf-land blowing," which summon into being with their far-resounding strains whole armies of mailed knights, clad in glittering panoply. About powerful enchanters, who change aged and wrinkled beldames into lovely women, or bowed and decrepit old men into stalwart warriors. About mighty and miraculous swords, such as the sword Balisardo, which cut even enchanted substances; or the sword Balmeny; or King Arthur's sword Excalibur, which, when first used in battle, "cast forth a great light full splendent, with such force that all those who beheld it thought that burning torches issued from it;" though in truth it was only the golden letters on the blade which shone so dazzlingly. It was this desire to escape from the mean associations of our social existence, and from that atmosphere of matter-of-fact engendered by an ever-advancing civilization, which, I believe, rendered our ancestors so partial to stories about far-off lands, and induced them to swallow so greedily the early traditions about Islands of the Blest, situated in some remote ocean, warmed by the rays of sunset, and inhabited by mortals, or rather immortals, whose happy lives were never obscured by a single cloud. But the Wonder-Land, or Wonder-World, in which such marvels existed, is now rapidly receding from our gaze. In this nineteenth century we are getting too wise, or too foolish, to trouble ourselves concerning the unreal. Who now knows anything about Fortunio, and his enterprise in quest of the terrible dragon? About his servants: Fine-ear, who, by putting his ear to the ground, could tell his master of the movements of the dragon when seven leagues distant? or Tippler, who, when they came to a river too deep to ford, and too

broad to leap over, settled the difficulty by drinking it up? or Strong-Back, who on his single pair of shoulders was able to carry provisions enough to serve all the company for days, and weeks, and years?

Who now remembers the beautiful legend of Peter Klaus, the goat-herd of Sittendorf, or how, while driving his herd one day to their favourite pasture, he was accosted by a young man, and compelled by some mysterious influence to follow him? He was led, says the old story-teller, into a deep shadowy ravine, surrounded by rock and crag and precipice, and in its depths he discovered twelve aged knights playing at skittles, not one of whom glanced at the intruder or uttered a word. Looking around him, his eyes lighted on a cup of wine, whose sweet odour enticed him to drink of it. But no sooner had he done so than an irresistibly drowsy influence stole over him, and he fell asleep. When he awoke, he found himself couched among the soft grass of the favourite pasture of his goats. But yawning widely, and stretching his limbs, and rubbing his eyes until he was thoroughly awake, he found that the scene around him was greatly changed. His dog had vanished, and so had his goats; the grass had sprung up several feet in height, and tall trees bowed around him which, when he fell asleep, were only saplings. Greatly perplexed in mind he betook himself to his native village. What transformations there astonished him! Little children had grown up into vigorous men and mature women; his playmates had exchanged the bloom of youth for the white hairs of old age; no one seemed to recognize him; and it was not until after a long interchange of question and answer he became convinced

that what he thought to have been an afternoon nap had proved, in very truth, a slumber of twenty years!*

Let us turn to another of these reminiscences of Wonder-Land; for in Wonder-Land only could such marvels have been. The poets have preserved for us the memory of the celebrated elf, Puck, or Robin Goodfellow, who appears to have acted as the fairy jester—a doer of practical jokes—a whimsical, mischievous, half-malicious, and half good-tempered sprite. In the olden times he played us mortals many a troublesome trick, and yet, when fairly treated, he seems to have been not unwilling to render useful service. At least the poet tells us—

"How the drudging goblin sweat,
To earn his cream-bowl, duly set,
When in one night, ere glimpse of morn,
His shadowy flail had threshed the corn,
That ten day-labourers could not end;
Then lies him down the lubber-fiend,
And, stretched out all the chimney's length,
Basks at the fire his hairy strength;
And cropfull out of doors he flings,
Ere the first cock his matin rings."

Does the reader recollect the story of Fortunatus? How, when he was in great peril from beasts of prey, and in terrible straits from want of food, a beautiful woman, with her eyes bandaged, and leaning on a wheel, suddenly appeared before him:—"Know, O youth," said she, "that I am Fortune, and that mine is the power to bestow strength and riches, wisdom, health, beauty, and long life. One of these gifts I am willing shall be yours. Choose which it shall be." The simple Fortunatus selected riches, in order, he said, that he might never again know what it was to be hungry. Thereupon Fortune

* This is the original of Washington Irving's tale of "Rip van Winkle."

gave him an inexhaustible purse, and away went Fortunatus on his travels, in huge delight with himself and all mankind. His apparent good luck was not yet ended. He fell in with a certain Sultan, who showed him a chamber brimmed up and blazing with costly jewels, and then, opening a secret closet, took out a *cap*, which he asserted to be of more value than a mountain of precious stones. This seemed a very wild statement to Fortunatus, who thought he had seen many a handsomer head-gear; but the Sultan undeceived him:—"Whoever wears this cap," said he, "and wishes to visit any part of the world, will be transported thither in a moment."

Provided with so marvellous a purse and remarkable a cap, you would think, perhaps, that Fortunatus would be the happiest of the happy; but even in Wonder-Land the gratification of our wishes, and the possession of unlimited wealth cannot secure true happiness, and Fortunatus eventually came to ruin.

Wandering thus among the mysteries and dim recesses of the old Enchanted World, I am also reminded of the awful cavern,

"Under the roots of the ocean,"

called Domdaniel, where, in a long-past and almost-forgotten age,

"Met the Masters of the Spell,"

the genii, magicians, and enchanters, who did with men as they willed. Nor can I forget the strange German legend of the Erl-King (*Erl-König*), who haunted of yore the shadowy glades of the Black Forest, and enticed into his power by all kinds of seductions the fairest and sweetest of human children. It has been embodied by a modern

poet in a ballad which deserves to be known to every reader:—*

"Who rides so late through the midnight blast?
'Tis a father spurs on with his child full fast;
He gathers the boy well into his arm,
He clasps him close, and he keeps him warm.

"'My son, why thus to my arm dost cling?'—
'Father, dost thou not see the Elfin-King?
The Elfin-King with his crown and train?'—
'My son, 'tis a streak of the misty rain!'

"'Come hither, thou darling! come, go with me!
Fine games know I that I'll play with thee;
Flowers many and bright do my kingdoms hold,
My mother has many a robe of gold.'

"'Oh father, dear father! and dost thou not hear
What the Elfin-King whispers so low in mine ear?'—
'Calm, calm thee, my boy, it is only the breeze,
As it rustles the withered leaves under the trees!'

"'Wilt thou go, bonny boy, wilt thou go with me?
My daughters shall wait on thee daintilie;
My daughters around thee in dance shall sweep,
And rock thee, and kiss thee, and sing thee to sleep!'

"'Oh father, dear father! and dost thou not mark
The Elf-King's daughters move by in the dark?'—
'I see it, my child; but it is not they,
'Tis the old willow nodding its head so gray!'

"'I love thee! thy beauty, it charms me so,
And I'll take thee by force, if thou wilt not go!'—
'Oh, father, dear father! he's grasping me—
My heart is as cold as cold can be!'

"The father rides swiftly—with terror he gasps—
The sobbing child in his arms he clasps;
He reaches the castle with spurring and dread;
But, alack! in his arms the child lay dead!"

The reader will begin to muse, however, why I linger so long in Wonder-Land; but my prelude is not incongruous with the subject of this little book. I have wished to show how strong an influence on the human mind the

* Goethe's *Erl König*.—I make use of Mr. Theodore Martin's excellent translation.

marvellous has ever exercised. God has endowed us with the faculty of imagination; that is, with the power of seeing with the mental eyes what is not revealed to the physical eyes. We are always yearning after things of beauty and shapes of grace; always picturing to ourselves scenes brighter and fairer than those immediately before our vision; always dreaming of worlds outside or inside of this actual, every-day world. We must not underrate this power. It works for good. It is a prime element in human happiness. A Scotch philosopher* has justly remarked that it is the great spring of human activity, and the principal source of human improvement. As it delights, he says, in presenting to the mind scenes and characters more perfect than those which we are acquainted with; it prevents us from ever being completely satisfied with our present condition, or with our past attainments, and engages us continually in the pursuit of some untried enjoyment, or of some ideal excellence. It was in just such a feeling that the ancient fables and legends of Fairy-Land and Wonder-Land had their origin. Men wanted to rise above themselves—above the conditions which clogged and fettered them—above the dust and ashes of vulgar pleasures. And, accordingly, they created for themselves a region of marvels and mysteries, in which their fancy wandered at its own sweet will.

Coleridge has wisely said that all philosophy began in wonder, that in wonder it ends, and that the intervening space is filled up with admiration. But, he adds, the first wonder is the offspring of ignorance, the last the parent of adoration.

* Dugald Stewart.

Well, then, our fairy tales and traditions being the offspring of ignorant imagination, it follows that as the world grew older, and, in many respects, wiser, they would lose their original flavour, just as the toys and amusements of the child become distasteful to the man of riper years. We have done now with the wonder of ignorance. What is to supply its place? Some food *must* be provided for the imaginative—that is, for the wondering faculty; some relief *must* be afforded to the inquiring mind from the dull circumstances of workday life. Otherwise, we should grow torpid, weary, and insensible; and we should begin to regret the straws and baubles which amused our childhood. To be wholly the slave of matter-of-fact is neither good for the mind, the soul, nor the heart; and this the poet* felt when he regretfully exclaimed,—

> "But lost, for ever lost to me those joys
> Which Reason scatters and which Time destroys!
> No more the midnight fairy tribe I view,
> All in the merry moonshine tippling dew;
> E'en the last lingering fiction of the brain—
> The churchyard ghost—is now at rest again."

We know that it is good for the physical health of the dweller in great towns—the man who has been long in city pent,

> "Where houses thick and sewers annoy the air"—

to go forth occasionally into the fresh, free atmosphere of the country,

> "To breathe
> Among the pleasant villages and farms."

It recruits his frame; it renews his energies. In like manner, the mind requires to escape from its daily occupa-

* Crabbe.

tion—from the counting-house, or the wareroom, the factory, or the loom—to taste the joys of the higher and purer senses, and drink in the inspiration of God's truth and beauty. We must learn not only to think and reason, but to admire and wonder.

But where, then, shall we find a substitute for the old Wonder-Land of the Middle Ages?

To fill up the void, Art has come forward, and Science. Art, by the pencil of the painter and the brush of the poet, has dowered us with exquisite creations, which prove to the refined imagination "a joy for ever." But Art is not universal in its favours. They are limited, in some degree, to a narrow range and a not numerous class. Let none, however, be disappointed; for Science now steps to the front, and shows to the delighted eye that the *true* Wonder-Land is ever around and about us—is this fair green earth of ours, is yonder blue arch of heaven, is the luminous air which enfolds us like a garment, is the mighty ocean beating on the shore with all its myriad waves!

Talk of enchanted swords which cut through enchanted substances—what are they to the lightning, whose subtle flash tears asunder the vigorous oak and rends the rugged rock?

Talk of spells and talismans, which open up the depths of treasure-caves—what are they to the microscope, whose powerful lens peoples a drop of water with a thousand strange and beautiful beings?

Talk of mysterious spirits winging their way through the air—what are they to the common fly, with all its exquisite perfection of structure, with the four thousand

facets belonging to each of its scarcely perceptible eyes, which reflect every object with so wonderful a degree of accuracy and minuteness?

Talk of the gauze wings of the fairies—what is *their* delicacy or fineness compared to that of the fibres or filaments, hundreds of which make up only one thread of a spider's web?

The old fairy tales tell us of demons and spirits, who, at the bidding of the magician, accomplished surprising works. I remember to have read * that the Scottish necromancer, Michael Scott, was once upon a time attended by one of these imps, for whom he was under the necessity of finding constant employment. To keep him occupied, he first ordered him to build a *cauld*, or dam-head, across the Tweed at Kelso—but it was begun and finished in a single night, and any visitor to Kelso may see how thoroughly the work was done. Michael then ordered that Eildon Hill, which at that time was a solitary summit, should be divided into three. When he awoke on the following morning, lo! three picturesque peaks towered against the bright blue sky! At length, the enchanter vanquished his indefatigable demon by employing him in the task of making ropes out of sea-sand, a task in which he is said to be still engaged!

This was the sort of work done in the *old* Wonder-Land. But in the *new* Wonder-Land—the Wonder-Land of Science—far grander and more useful achievements are being effected, and by a far more powerful agent. What demon or imp may be compared to man's servant, *Steam*, which drives huge piles deep into the ocean-bed; which

* In Sir Walter Scott's Notes to "Marmion."

exhausts the water out of the bowels of the earth; which flattens the massive iron bar into a thin plate; which fuses the hardest rocks, and melts the solidest metal; which forces the ship against the heaving billow and adverse wind; and drives the railway-car over plain, valley, and mountain at the rate of a mile a minute?

In the old Wonder-Land, knights blew mysterious horns, whose sounds travelled over miles of air, and summoned warriors to the distant field—but what are these compared with the electric wire, which flashes intelligence across a thousand leagues of ocean, and puts a girdle round about the world in forty minutes?

We are told, too, in the ancient legendary lore, of the marvellously coloured robes in which nymphs and princesses disported themselves; and the tale-tellers run riot in describing their prismatic tints—emerald, and amethyst, and opal, sapphire, topaz, and jacinth. But would any of these ever have vied with the magical colours recently extracted by Science from so mean and apparently worthless a substance as coal-tar? With aniline, mauve, or magenta, or any other of the beautiful hues which the chemist has placed at the service of modern magicians?

But I have said enough to convince my readers that the old Wonder-Land is infinitely inferior to the new, and that Science brings before us miracles and marvels such as the brain of the ancient poet never conceived of. I shall now confine my remarks to one particular scientific department, in which it is easy for any of us to pursue our researches, with the encouraging knowledge that these researches will admit us to a truly enchanted region, and

make us masters of spells and charms and talismans far beyond those of the fabulous enchanters of old.

Of all the "fairy tales of Science," I think none are so delightful as those which the botanist recites; and of all the different provinces and domains into which the wonder-land of Science is divided, not one, I think, is so rich in beauty as that of which the botanist possesses the key. It lies, however, close to the door of each one of us. The nearest hedgerow belongs to it; the wayside pool; the ferny hollow; the little bit of cottage garden; the wood-land shade; the furrowed cornfield; the turfy lawn; the heather-clad hill;—yes; this Wonder-Land is ever present and ever near us, and none who have eyes to see need dread to cross its borders.

II.—THE LEAF.

"Lo! in the middle of the wood,
The folded leaf is wooed from out the bud
Which winds upon the branch, and there
Grows green and broad, and takes no care,
Sun-steeped at noon, and in the moon
Nightly dew-fed; and turning yellow,
Falls, and floats adown the air."

TENNYSON.

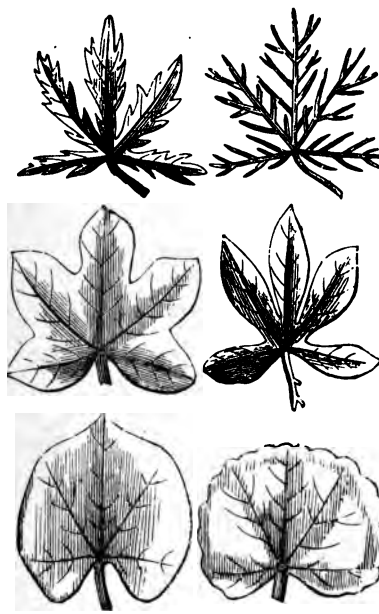
WHAT a beautiful thing is a leaf! Whether it be the green, fresh, living leaf, full of sap and vigour, which waves so merrily in the soft airs of spring; or the wrinkled, withered, and fast decaying relic,—

"The last of its clan
That dances as often as dance it can,
Hanging so light, and hanging so high,
On the topmost twig that looks up to the sky." *

I never saw an ugly leaf. Some are fairer in shape and more winning in colour than others, but all are characterized by a certain degree of gracefulness, and by a certain artistic perfection of workmanship. This workmanship is indeed remarkable. Only consider the variety of form. Each tree, each plant, has its own peculiar leaf. That of the ash is as unlike that of the beech, as that of the vine is unlike that of the marsh-mallow.

* Coleridge.

(*a*.) Now observe how greatly man gains by this arrangement. He gains in simplicity, for he is enabled to recognize the tree by its leaf, and if you took the leaf of a foreign plant, which he had never seen before, to a scientific botanist, he would at once be able to tell you to what kind of tree it belonged, and what were the probable uses of that tree. For on the leaf is painted, as it were, the outline of the tree of which it forms a part—just as if you were to draw upon your hand a likeness or picture of yourself. The shape of the leaf determines the character of the tree. Small hands and small feet are sometimes said to be distinctive of a gentleman. From the face some physiognomists will tell you all about the man. In like manner, if I fall in with a narrow angular leaf, I know that it belongs to a tall, angular, pyramidal tree—like the fir for instance—and in my mind's eye I can build up all the structure of that tree; if the leaf be



VARIOUS KINDS OF LEAVES.

broad and flat, I know its parent tree will be wide-spreading, many-branched, umbrageous, such as the sycamore or elm.

Everybody knows that the leaf is wrought all over with veins or fibres — well, these veins, or fibres, invariably imitate the ramification of the branches and trunk of the parent tree. They are both thrown off at the same angles, and are so exactly identical that, as I have already said, you may readily figure to yourself the appearance of the whole tree from which it fell or was torn. An old Greek jest-book records as an amusing instance of the simplicity of a certain Hierocles, that, when sent to examine a house, he brought back a *single brick* as a specimen of it. There would be no absurdity, however, in offering a solitary leaf as a specimen of a great tree. It would enable us to re-create the tree in our imagination as easily as Professor Owen re-created the lost bird—the Dodo—from one small bone.

Oak Leaf.

It is also noticeable that trees whose boughs descend to

within a few feet of the ground, like the oak, have leaves with very *short* footstalks; while those whose trunks are tall and naked, like pillars of stone, have leaves with *long* footstalks.

There are plants which would be injured by immediate contact with any rough substance, or by an insect's touch; you will find their leaves covered over with a down or fur that handsomely protects their surface. Others need all the nourishment they can draw from the air, and for this purpose their leaves are furnished with numerous fine hairy tubes, which inhale the atmospheric moisture, and convey it to the sap-vessels of the plant.

TROPICAL LEAVES.

The leaves of Tropical trees and shrubs, as far as I have observed, are very much larger than those of the trees and shrubs of England or Europe. This would seem to be the provision of a merciful Creator to enable them to receive upon their broad surface whatever humidity the atmosphere contains.

A narrow leaf, moreover, would be sooner shrivelled and scorched by the brazen sunshine of a torrid clime.

(*b.*) I have said that by this diversity in the formation of leaves man gains in simplicity. He also gains in beauty; in the pleasure afforded to the eye by such infinite variousness. How tame, dull, and uninteresting a grove or forest would appear if every leaf were alike—if the entire mass of foliage was distinguished by a monotonous uniformity! If each leaf were moulded on its brother, or cut after the same pattern, how the fatigued and dissatisfied eye would ache! We should grow weary in time of a cloudless blue sky, but we should tire still more quickly of a forest where all the leaves were in form and fashion identical. Everybody knows that a plantation of firs is not so pleasing to the spectator as a luxuriant forest, where beech and oak and chestnut stand side by side, and elm and birch diversify the scene. The mind of man requires change and variety, whether you appeal to it through the eye or the ear; and God has abundantly supplied them, even in the apparently insignificant matter of the leaves of the trees.

HOLLY TREE (*Ilex Aquifolium*).

(*c.*) But we also gain in utility. If all leaves were

alike, all trees would be alike; in which case they would require one and the same soil, situation, and climate. But, on the contrary, they are adapted to every possible condition of circumstances. In plants that are tender and weak they change into tendrils, which cling to stronger plants, to walls, or the surface of rocks—just as the tottering babe clings to its mother's arm. In plants that are very liable to injury they become spines; and it is noticeable that in the holly, as you may see for yourself, the leaves nighest the ground are most thickly provided with spines, while those at the top of the tree are perfectly free from them.

Leaf of Holly.

"Below a circling fence its leaves are seen
Wrinkled and keen;
No grazing cattle through their prickly round
Can reach to wound;
But as they grow where nothing is to fear,
Smooth and unarmed the pointless leaves appear."*

In plants flourishing in cold bleak localities the leaves are narrow and rough, so as to offer little advantage to the cold; but in those which dwell in low situations they are broad and tender. To enable the myrtle and mint, which are found not only in our quiet sheltered gardens, but high up the sides of snow-crowned mountains—to enable them, I say, to endure the icy air, their leaves are furnished

* Southey.

with stores of oils and resinous matters; just as the Polar bear, the seal, the walrus, and all animals exposed to the severe winters of the Arctic regions, are provided with thick layers of fat, partly as a protection, and partly as a source of nourishment. In our European plants the skin (or cuticle) of the leaf has but a single row of thin-sided cells; in Tropical leaves, on the contrary, to screen them against the heat of the day and the cold of the night, you will find three or four layers of stout thick cells, which is the cause of their leathery appearance. In plants with delicate blossoms the leaves are so fashioned and arranged as to afford a sufficient defence; when the flower is robust and full of life, it soars above the foliage, which then droops and flags beneath, like a throng of knightly banners.

MYRTLE (*Myrtus*).

An observant writer remarks of the water-ranunculus —what is true of all aquatic plants, as a glance at the nearest brook or pond will convince you—that the leaves floating on the surface of the water are round and broad, while the lower ones, immersed beneath, are subdivided into narrow segments, or strips, so as to offer the slightest possible resistance to the force of the current. A similar arrangement is noticeable in the common gorse, or whin, whose golden summer-glory lights up so many a waste place and barren heath; the sharp needle-like leaves and

stems are evidently designed to yield to the breeze that sweeps over their open dwelling-places. In the tropical plants, however, their adaptations to special ends are still more remarkable. Some of the orchids, for instance, cannot be fertilized without the aid of insects, and are, therefore arrayed—as Solomon never was arrayed—in order to attract them. The Venus' fly-trap* of North America has its leaves set upon a hinge, and guarded all round with long, stiff, bristly hairs, which are so disposed that neither fly nor gnat can traverse the leaf without touching them: whereupon the two sides fold together upon the insect, and hold it as in a trap until it is dead. It is supposed that the plant sucks the juice out of its prey; by others, that it receives nourishment from the body, which is dissolved by a mucilaginous exudation from its glands. This, however, has not been definitely ascertained; but if true, what a singular arrangement that the apparently in-

VENUS' FLY-TRAP (*Dionæa Muscipula*).

* The *Dionæa muscipula* (natural order, *Droseraceæ*).

animate plant should entrap, and kill, and feed upon the living insect!

Not less singular is the mimosa, or sensitive plant, whose delicate foliage shrinks from the touch even of a child's light finger. Was there any phenomenon of greater or more curious interest in all the Wonder-Land of the old story-

SENSITIVE PLANT (*Mimosa sensitiva*).

tellers? We know not why the plant has been endowed with this property; but we are certain it was designed to answer some wise purpose. Probably it had a defensive object.

Another circumstance to be considered with regard to the leaf is its variety of colouring. Green, it is true, is the principal tint, but every shade of green, from the light-emerald of the ash to the deep brownish gloom of the beech, is illustrated in the foliage of trees. What sight more beautiful, in all this wide earth, than the woodlands in early spring, when—

"The long drooping boughs between,
Shadows dark and sunlight sheen
Alternate come and go;"

and the eye rests delighted on the soft mingling of the different tints, as they swell in exquisite gradation from the brightest and clearest to the richest and fullest colour? But Nature does not confine her fairy children to this single adornment. She is well aware that green is singularly grateful to the human vision—as everybody knows who has turned from a long reach of chalky cliff to bathe, as it were, his fatigued eyes in the cool fresh meadows—but she is also aware that the mind and imagination of men find a huge pleasure in diversity; and she, therefore, sprinkles gold and purple, amethyst and opal, orange and scarlet, over the attire of her trees and plants. It should be noticed that, as a rule, the plant with the gayest flowers has always the dullest foliage; where the blossom is small and dull, the leaves are large and gorgeous. Many plants owe all their attractiveness to the rich colouring of their leaves; as the begonia, for instance, which is a perfect marvel of gorgeous decoration, and whose coloured foliage is so beautiful, that it can well dispense with floral embellishment. What is the object of this splendour? Is it intended wholly for the gratification of man? Or does it fulfil any mysterious purpose connected with the economy of the plant? Or may it not have been designed by the Creator for his own pleasure—for the pleasure of Him who, when he looked down on the fair earth which His word had summoned out of chaos into order and beauty—on its rolling seas, woods, rivers, hills, and valleys—pronounced all things good;—for the pleasure of men and angels, and the spirits of the just and perfect, who, with ripened faculties and developed intelligences, may well be supposed to enjoy a keener and more exquisite sympathy

than their mortal frames ever knew with all that is lovely, fair, and pure?

Let us consider some other properties of the leaf.

In the first place, we must remember that the leaf is the plant, that the plant springs out of it, and is wholly made up of it. We owe to a German poet* the grand discovery that the flower of a plant is not, as was supposed, an independent or additional organ, but simply the full development or transformation of its leaves; that all the parts of a plant, from the seed to the blossom, are neither more nor less than modifications of the leaf.

Begin at the beginning—with the seed. What is it, when carefully examined, but a leaf folded up very tightly, with some alteration of structure and tissue, so as to adapt it to its subterranean life? In like manner, the bud consists of two or more leaves bound up together, which in winter are covered with a kind of leathery wrapper, to shield them from the frost! It is a great mistake to talk of a tree or plant as *leafless:* it is never without leaves. except when dying. During winter, however, they are packed up, as it were, in a secure case; and while they are thus packed up, the sap ceases to be elaborated, and the wood of the tree developed. Now turn to the stem. Here again we find the leaf, but assuming a variety of shapes, and undergoing numerous transformations. Sometimes it is rolled and compressed into a bulb; sometimes it rises above the ground in a tall pillar-like structure, so as to expose its organs as much as possible to the genial influences of the air and light. All leaves are arranged upon the stem after two leading patterns—the *whorl* and

* Goethe.

the *spiral;* but as by tearing out the whorl you get at the spiral, and by compressing the spiral you obtain the whorl, we may say, after all, that the whorl and the spiral are essentially the same. The number of leaves required to form the stem differs, of course, according to its size, but in every *species* is generally uniform. In the common house-leek, so indispensable an addition to every cottager's soup, the stem consists of no fewer that thirteen leaves.

HOUSE-LEEK
(*Sempervivum tectorum*).

But not only the seed, the bud, and the stem are made up from the leaf; it is from the leaf God has planned the branch and the bough, the flower and the fruit—a beautiful proof of the unity and harmonious simplicity of the divine work.

Flowers are leaves; so disposed as to protect the various organs of life concealed within them, and gaily pranked with colours to attract the insects which distribute abroad the fertilizing pollen or dust, as also to absorb and drink in the light and heat requisite for the full maturing of the seed.

Fruits are leaves; transformed in texture and contents, and arranged in every variety of outline, but still modelled upon the leaf pattern. Take, for instance, the apple; the upper surface of the leaf is repre-

sented by the core, the flesh is the cellular tissue puffed out and swollen. In the orange, the different sections of the leaf are found in the juicy pulp or tissue enclosing the seeds. In the peach, what is the stone but the hardened upper skin of the leaf, and what the pulp but the cellular tissue of a leaf expanded and endowed with nutritious properties for the support of the infant plant? The rich downy skin on the outside is the lower cuticle of the leaf, touched by the sunlight with a purple bloom—the hollow line or fissures on one side of the fruit denoting the union of the two edges of the leaf.

"In all the parts and organs of the plant, then," says an eloquent writer,* "from the seed to the fruit, we find that the leaf is the type or pattern after which they have been constructed; and those modifications of colour, composition, and structure, which they exhibit, are, in the first place, designed for special purposes in the economy of the plant; and, secondly, for necessary services to the animal creation, and even to man himself, to whom the sweetness of the fruit and the beauty of the flower must have had reference, in the gracious intentions of Him who has created them both."

But I have not yet done with all the wonders of the leaf. I now come to consider its special functions in connection with the *life* of the plant. Well: it is to the plant what the lungs are to man, or the gills to a fish—without its leaves the plant cannot breathe, and unless it breathes the plant must die. The leaf inspires or absorbs the carbonic acid floating in our atmosphere, disengages the carbon which it contains, and builds it up into tissue,

* Macmillan, "Bible Teachings in Nature."

while the oxygen mixed up with the carbonic acid it suffers to return into the air. This process is continually going on, and much, I can assure you, to our human advantage. For the carbonic acid contained in the atmosphere is a deadly poison, and yet it is being incessantly given off from mineral waters, from the combustion of minerals and fuel, from volcanic fissures in the earth, and from the lungs of men and animals.

As a proof of its deadly qualities, I may refer to the celebrated — the unhappily celebrated — instance of the Black Hole of Calcutta. Surajah Dowlah, the Nabob of Bengal, having captured the small English garrison of Fort William, at Calcutta, shut them up in a small prison, only twenty feet square. The air-holes were small and obstructed. It was the summer solstice, when the fierce heat of Bengal can scarcely be endured by Englishmen even in the loftiest and coolest halls. The number of the prisoners was 146. When they were ordered to enter the cell, they imagined the soldiers were jesting. They soon discovered their mistake. At the point of the sword they were driven into the cell, and the door was instantly shut and locked upon them.

The horrors of that night no words can paint. In vain the sufferers cried for mercy; they strove to burst the door; they offered large bribes to their gaolers. Then they went mad with despair. They trampled each other down, fought for the places at the windows, fought for the drop of water with which the murderers mocked their agonies, raved, prayed, blasphemed, implored the guards to fire upon them. At last the day broke; the door was thrown open; and twenty-three ghastly figures, such as

their own mothers would not have known, staggered one by one out of the charnel-house, on whose loathsome floor lay no less than 123 dead bodies.*

Chemically speaking, they were killed by the carbonic acid exhaled from their own lungs, and confined within a narrow area, where a free circulation of wholesome air was impossible.

What took place in the Black Hole of Calcutta would take place over the whole earth, had not the Creator guarded against it by His wise and beneficent provisions. But this element, so fatal to animals, is the very life of plants. While man dreads it as a poison, the plant absorbs it as food. And by this very act it helps to purify the atmosphere; so that nothing in all nature runs to waste. There is a constant equipoise preserved—a perfect balance between good and evil, life and death; and the refuse and waste of one part of creation becomes the nourishment and vitality of the other.

If you have ever looked into a brook or pond on a bright summer's day, you must have noticed, dear reader, a number of bubbles rising constantly to the surface. These air-bells are the oxygen liberated by aquatic plants, while engaged in decomposing the carbonic acid gas diffused through the water, and are so many small but precious contributions to the purification of the air we breathe.

But the leaf also absorbs a considerable amount of vapour. Generally the plant derives its chief supply of moisture from the ground—the excessive absorption being transpired by the leaves; but the leaves also receive and inhale direct a certain amount of vapour. Here again we

* Macaulay, "Critical and Historical Essays."

meet with a counter process. Not only do the leaves *in*hale, but they *ex*hale; not only do they *in*spire, but they *tran*spire. The great law of creation seems to be, "give and take." Different plants inhale different quantities of fluid. A sunflower, 3 inches high, throws off 20 ounces of watery fluid daily. A cabbage, with a surface of 2736 square inches, transpires at an average 19 ounces; a vine, of 1820 square inches, from 5 to 6 ounces. These facts serve to show the importance of providing certain vegetables and plants with abundant moisture. According to their capacity of *ex*haling fluid is their capacity of *in*haling it; and the cabbage, it is evident, will require twice as much water as a vine.

You may amuse your leisure, reader, with an experiment on the exhalation of plants, which I borrow from Professor Balfour.*

Take a fresh leaf with a long footstalk; put it through a hole in a card which it exactly fits; and apply the card firmly and closely to a glass tumbler about two-thirds full of water, in such wise that the footstalk shall be inserted in the water.

Next, invert over the leaf an empty tumbler, and expose the whole to the sun; the fluid exhaled will be seen on the side of the tumbler. But put your tumbler in a dark closet, and no exhalation will take place, as the process can only be carried on under the stimulus of light.

It is this constant exhalation which imparts moisture to the atmosphere, and hence the greater humidity, or dampness, of a wooded district compared with one which is deficient in trees.

* Professor Balfour, "Manual of Botany."

We now come to the question, Why do leaves die? In cold countries, through the absence of heat and light, which induce a sluggishness or torpidity in the organs of the leaf, its fluid disappears by evaporation, and it has no longer the power of repairing the loss; hence all its cells and vessels contract and shrivel up; its breathing pores become obstructed; the entire surface of the leaf grows dry; its various parts lose their adherence; and it either falls by its own weight or is detached by the wind. During this series of processes it changes its colour, and the woodlands accordingly assume those rich and varied tints which make their autumnal glory.

In hot countries, the dry season produces a similar effect.

I conclude my remarks upon the leaf with a short explanation of its structure. It first makes its appearance as a little conical body projecting from the stem or branch. It then consists entirely of what is called *cellular tissue*, continuous with the bark; but afterwards vascular tissue is generally developed in it. As a rule, the leaf contains two parts: a *stalk*, called the leaf-stalk or *petiole*—which in grasses assumes the form of a sheath; and an expanded surface, called the *blade* or *limb*.

When the petiole is wanting, the leaf is said to be *sessile;* when it is present, the leaf is designated *petiolate*.

Sometimes leaves are *perfoliate;* that is, their base wholly encircles and encloses the stem, which seems to emerge from the leaf.

Leaves are said to be *simple* when all their parts are combined into one whole by a continuous cellular tissue—when, in fact, they consist of a single piece, however that

piece may be divided, as the leaf of the laurel, elm, or geranium; they are said to be *compound* when they include a number of distinct, completely separated parts, called *leaflets*, as in the leaf of the horse-chestnut.

Leaves which die off at the close of a year are distinguished as *deciduous;* those which endure for a longer period are *evergreens.*

Take a leaf into your hand, and you will observe that its surface is marked by several well-defined and somewhat rigid threads—these are its *nerves;* the finer ramifications are its *veins.*

LEAF, SHOWING NERVES AND VEINS.

The veins are always arranged in one or other of three ways; and each mode of venation (as it is called) has, therefore, been employed to distinguish one great order of plants, as it invariably indicates the internal formation of the stem. All plants with similarly veined leaves will have the same kind of stem, and root, and manner of life: just as all persons with woolly hair, flat noses, and black skins will have the general characteristics of the Negro race; and all persons with smooth hair, white skin, and straight noses the leading features of the Caucasian type.

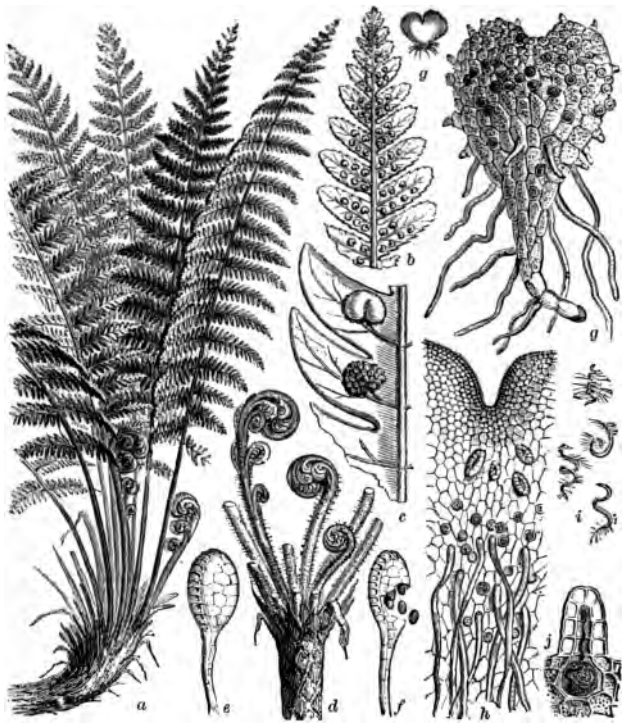
The three classes are named *Exogens*, *Endogens*, and *Acrogens.*

Of the *Exogens*, the principal distinction is that a vein,

which forms a continuation of the stalk, strikes through the centre of the leaf, dividing it into two equal portions, and throwing off on either side several primary veins towards the edges, which veins subdivide into smaller ones, until the surface of the leaf resembles fine network. To this class belong the vine, currant, geranium, chestnut, and, indeed, all the highest developments of vegetable life. The seed of these plants has always two lobes or compartments, and consequently they are sometimes known as *Dicotyledons* (from δὶς, twice, and κοτυληδὼν). All our British trees are Exogenous or Dicotyledonous.

Inferior in development and structure are the *Endogens*, which are also called *Monocotyledons*, because their seed has but a single lobe. Take the leaf of a lily or a grass, and you will observe that the veins run parallel to each other on its surface without any ramification or interlacement, and you can tear it from base to apex in a regular manner along the line of either vein. In the Endogens the flowers are few and plain, the leaves are large but scanty, the stem is branchless, and the wood is merely cellular tissue or pith. Some of our British herbaceous plants, but none of our trees, are included in this class, which is best represented by the palm.

I come, lastly, to the *Acrogens*, or *Acotyledons* (that is, "without seed-lobe"), a flowerless family of plants, like the ferns, mosses, and sea-weeds. Their leaves—to use an Irishism—are not *leaves*, but *fronds*, wherein the veins spread in a fan-like form from the base to the margin, and each is divided and subdivided into two smaller ones. They generally grow at the summit of the stem, which is unbranched, and possesses neither true bark nor distinct



FERNS AND THEIR PARTS.

a, Fronds and root-stalk.
b, Frond, showing the spore-cases.
c, Exterior and interior of seed-vessel.
d, Fronds, gradually unfolding.
e, A Theca, or spore-case, before opening.
f, A Theca, or spore-case, discharging its spores.
g, Prothallus of its natural size.
h, Lower surface of prothallus, much enlarged, showing the organs whose reciprocal action determines the development of the fern.
i, Various forms of one of these organs when in movement.
j, Enclosed vesicle, in which the development of the fern commences.

pith. This kind of plant, which is the very simplest, is sometimes named *cryptogamic*, because its reproductive

organs are concealed, or, at least, are not very conspicuous.

On the moral lessons of the leaf I am prevented from dwelling by my limited space. However, they are so obvious as almost to suggest themselves to every spectator. Their bloom and beauty reminds us of our vigorous youth; their rapid decay of our brief span of existence. A genial writer * remarks that, as they wave and dance in the wind, they seem light, and useless, and idle, and changeable, yet God has made them a part of the oak; and in so doing, He has given us a lesson that cheerfulness of spirit is not incompatible with strength of character. I say nothing of the marvellous testimony they bear to the existence of a superintending and all-designing Creator, who has disposed every part in the most admirable relation to the great whole, and made even the quivering leaf an essential member of the grand scheme of the universe—exhibiting a forethought, and a skill, and an adaptation of means to end which are as truly significant of Almighty wisdom as the thunder and lightning are of Almighty power: every line I have written is illustrative of these all-important truths. I turn from the falling leaf with an acknowledgment that, above all and before all, it is a significant emblem and parable of human mortality. As the leaf drops from the naked bough, so into the dim Infinite falls the vanishing human life.

"Leaves have their time to fall,
And flowers to wither at the north wind's breath.
But thou *all* seasons—all;
Thou hast all seasons for thine own, O Death!" †

* Leigh Hunt. † Mrs. Hemans.

III.—THE ROOT.

"Wonderful, indeed, are all His works,
Pleasant to know, and worthiest to be all
Had in remembrance always with delight."
MILTON.

WHILE the plant is in its infancy, no distinction can be found between stem and root; both are cellular, and both simply an extension or prolongation of each other in opposite directions. If the plant is a *thallogen*—that is, stemless—the root always remains in a cellular condition.

As the plant grows and ripens, we distinguish the root from the stem by the circumstance that the latter bears no leaf-buds, and increases either in a downward or lateral direction.* The part where root and stem unite is called the *neck*.

In most plants the root grows underground, and for this reason is colourless. Externally, it has a delicate skin-like or epidermal covering; internally, its structure consists partly of cells, and partly of vascular bundles, without any real pith. From the axis are thrown off certain branches, which, in their turn, throw off various spongy fibrils, or

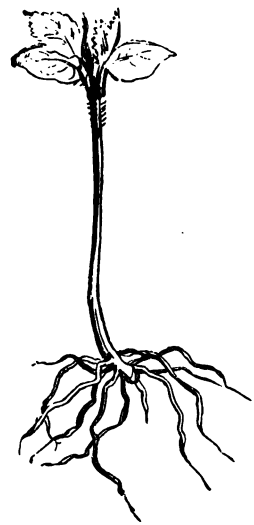
* It should, however, be observed that a *few* plants, such as the plum, japonica, and peony, have the faculty of developing buds upon their roots.

radicles, or sub-roots, forming sometimes a very extensive ramification. In a few plants the root is enclosed in a sheath. In others, as in parasitical plants, which feed upon other plants, it is frequently produced in the form of suckers. In the ivy, root-like processes are given off the stem, which insert themselves, like fingers, into the chinks and fissures of trees, rocks, and walls. These exuberant and web-like roots, says Washington Irving, issuing as they do from every portion of the branches on which it grows, bind everything together that comes within their reach with such a firm and intricate lace-work, that not a single stone can be removed from its position until you have first torn away its protecting safe-guard.

Not all roots are underground. Some are aerial, and the plants to which they belong are, therefore, called *epiphytes* (ἐπι, upon, and φυτὸν, a plant), or air-plants. Such is the case with the banyan, the screw-pine, and many other species of *Ficus*, where they prove of great assistance in sustaining the central stem and branches. The mangrove also projects its roots into the air, and they descend straight into the muddy soil which the plant loves; helping to fix it there, and to prevent its being uptorn by rising floods, just as we steady a tent by fastening it down on every side.

The forms of roots are almost as various as those of leaves. When the axis strikes deep into the ground in a tapering manner and without dividing, it forms a *tap-root;* —which is sometimes short and succulent, like that of the carrot; sometimes *fusiform*, or spindle-shaped, like that of the turnip; or it is twisted; or it ends abruptly. If the

descending axis is very short, and ramified into numerous thin fibres, as in several species of grasses, it is called *fibrous;* if these are developed like tubercles, and full of



ROOT OF MELON.

ROOT OF TURNIP.

starchy matter, the root is *tubercular;* if knotty, it is *nodulose:* or they may be short and juicy, and then the root is *fasciculated. Tubers* and *bulbs* are also developments of the root, and usually are found in esculent vegetables, employed as food for animals.

Some of the lower classes of plants, such as the *Algæ*, possess no root at all, but adhere to the ground, or any other object, by means of very minute fibres.

The great functions of the root are two: in the first place, it attaches the plant to the soil, and prevents it

from being overwhelmed by furious elements. In the second, it feeds the plant, by absorbing from the earth the sap necessary to its growth. For this purpose its structural development is peculiarly adapted. The bulb or tuber growing in the dry soil of Africa is composed of a succulent tissue which imbibes every drop of moisture to be found beneath the surface, and retains it so long as may be needful for the support of the plant. Trees which do not require much moisture have invariably a very limited root-growth; those which cannot live without a considerable quantity strike their roots far and wide, covering an immense area of ground, and if growing in the vicinity of a stream sending them as near as possible to its healthful waters. Coniferous trees have small roots: but these trees do not depend upon the soil for sustenance; their means of growth is almost entirely derived from the atmosphere.

It should also be noted that umbrageous trees—trees with far-spreading branches—always extend their roots laterally over a wide area, so as to obtain a counterpoise to the top weight, and fix themselves more firmly in the ground. By the same contrivance they are able to secure an abundant supply of nutritive matter.

To some roots tubercles are attached, containing starch and gum, which serve for the sustenance of the young plant. These may be seen, to name a common instance, in the dahlia. On the roots of the *Spondius tuberosa* black-coloured tubercles exist, each about eight inches in diameter, and composed of a white cellular substance which is full of water. We can readily understand the value of these subterranean reservoirs in the hot dry sea-

son. They are often dug up by travellers, and each supplies about a pint of a clear and refreshing fluid.

In the barren wildernesses of South America a strange plant is found—a species of club-moss, the *Selaginella convoluta*. In the hot season, when the soil crumbles into lifeless dust, this plant is detached from its habitat, rolled into a ball, and borne by the gale over leagues of sand. If it alights in a dry place it remains coiled up; but if carried to a marsh, or the bank of a stream, it unfolds, spreads itself out on the ground, regains its pristine freshness, takes root anew, and springs into vigorous life. But as soon as this second dwelling-place is dried up, the wanderer betakes itself to another situation.

IV.—THE FLOWER.

"In all places, then, and in all seasons,
Flowers expand their light and soul-like wings,
Teaching us, by the most persuasive reasons,
How akin they are to human things.
And with child-like, credulous affection,
We behold their tender buds expand,
Emblems of our own great resurrection,
Emblems of the bright and better land."

LONGFELLOW.

IF I were going to discuss the properties and attractions of flowers, or their poetical and historical associations, I should surely need a volume for each branch of my subject. Of all the "things of beauty" with which God has dowered the earth, or which he has enabled us to conceive and comprehend, none are dearer to our affections than are these. They have been called "the stars of earth;" but the comparison is in several respects unsuitable. It is certain, for instance, that we regard them with a warmer and tenderer feeling. The heavenly spheres are so remote from us—so awful in their sublime and mysterious loveliness—that we can only look upon them with awe and trembling.

"They are
A beauty and a mystery, and create
In us such love and reverence from afar,
That fortune, fame, power, life, have named themselves a star."

But the flowers are our daily companions, the sunshine of our lives, the attendants of our walks, the prized favourites of our boudoirs, the cherished inmates of our gardens. We love to caress and handle them, to delight our eyes with their bloom, to inhale their fragrant breath. We place them on our mantelpieces, on our study-tables, by the bedside of the sick, on the graves of our dead. We look upon them as the fond emblems of many a wise and pleasant thought, the symbols of many an event which has had its place in our life-history. So dear have they ever been to the poets, that to name but one of them suggests a hundred passages in which it has been celebrated. To the lover they are the words of a silent, yet eloquent language. To the artist they are precious from their unrivalled loveliness and grace. Nor, even in a meaner sense, are they without their value;—to the druggist they are recommended by their efficacy in lotion and medicament; to the chemist by the potency of the essences he extracts from their ethereal substance; and for the philosopher there is an attraction in the exquisite simplicity of their structure, in the admirable combination of their parts, and in their adaptability to various conditions of soil and climate.

Two properties of flowers are specially noticeable; they are, indeed, the properties for which we mainly value them—colour and scent.

What shall we say of the *colours* of flowers? Do they not traverse the entire chromatic scale? Do they not embrace every ray of the prism? Can you not gather from the meadow, the woodside, or the pasture, a posy which shall so flush with rose and purple, so sparkle with

sapphire and emerald, so glow with jacinth, ruby, and amethyst, that the eye cannot be satisfied, any more than the ear can ever be sufficiently filled with a perfect melody? Think of the colour in which the following picture is steeped, like a lake in sunlight:—*

"The pied wind-flowers,
and the tulip tall,
And narcissi, the fairest
among them all, ...
And the Naiad-like lily of
the vale,
Whom youth makes so fair
and passion so pale,
That the light of its tremulous bells is seen
Through their pavilions of
tender green;
And the hyacinth purple,
and white, and blue,...
And the rose like a nymph
to the bath addrest,
Which unveiled the depth
of her glowing breast,...
And the wand-like lily,
which lifted up
As a Mœnad, its moonlight-coloured cup,...
And the jessamine fruit,
and the sweet tuberose,...
And the sinuous paths of
lawn and of moss,

* Shelley.

THE WHITE LILY (*Lilium album*).

Which led through the garden along and across,
Were all paved with daisies and delicate bells,
As fair as the fabulous asphodels,
And flowerets which drooping as day drooped too,
Fell into pavilions, white, purple, and blue."

Here is another flower-picture of even warmer glow and riper bloom:—*

"Above his head,
Four lily stalks did their white honours wed
To make a coronal; and round him grew
All tendrils green, of every bloom and hue,
Together intertwined and trammelled fresh:
The vine of glossy sprout; the ivy mesh,
Shading its Ethiop berries; and woodbine,
Of velvet leaves and bugle-blooms divine;
Convolvulus in streakèd vases flush;
The creeping, mellowing for an autumn blush;
And virgin's bower, trailing airily;
With others of the sisterhood."

Such, then, is the diversity of the shades, and hues, and tints of the flowers. Those of the richest and most luxuriant warmth are usually of tropical growth; but the airiest and most delicate belong to temperate climes. The subject of the colours of flowers is one, however, which has not as yet been very thoroughly investigated. We know, indeed, that they depend upon certain chemical products, and are, to a great extent, the direct result of the action of the sun's rays. Light is as essential to the flower as to the human being. Deprived of it both man and the flower would grow wan, etiolated, and meagre. We know, too, that they may be modified by soil, may be increased or diminished in intensity of depth and fulness of hue. But we know little more. We cannot say what direct relation exists between the colour and the life of the plant—why a flower growing in loam should differ in tint from one flourishing in sand,

* Keats.

why the gorse should be yellow as gold or the violet blue as heaven.

The same difficulties beset us when we come to consider the scent of flowers. We know that their sweet fragrance, which loads the wings of the wind with balmy odours, is due to their possession of certain chemical properties; but we cannot satisfactorily answer the question — Why are flowers perfumed? Why are some gifted with the most delicious breath, while others exhale a perfectly offensive smell? Why are some endowed with beauty of bloom, but not with Arabian odours? Take, for instance, the belladonna; its structure is exquisite, its colours are magnificent; but while it enchants the eye, it refuses to gratify any other organs.

BELLADONNA (*Atropa belladonna*).

An old writer,* in reference to this interesting but

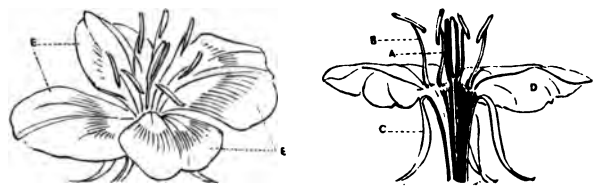
* Bishop Hall.

mysterious subject, remarks:—"Whence comes the delicate scent of the rose and the violet? It is not from the root—that smells of nothing; not from the stalk—that is senseless as the root; not from the earth whence it grows, which contributes no more to these flowers than to the grass that grows by them; not from the leaf, not from the bud, before it be disclosed, which yields no more fragrance than the leaf, or stalk, or root; yet here I now find it: neither is there any miraculous way but in an ordinary course of nature, for all violets and roses of this kind yield the same redolence; it cannot be but that it was potentially in that root and stem from which the flowers proceed; and there placed and thence drawn by that Almighty Power which hath given these admirable virtues to several plants, and induces them, in His due season, to these excellent perfections."

It is evident that the scent of flowers is in some degree connected with the influence of light and air, and certain conditions of climate, for the flowers of the Tropics are almost scentless, and the same may be said of blossoms that grow in northern latitudes. The most fragrant are those which belong to the temperate regions of the earth: and exquisite as are, for instance, the roses of Pæstum, in Italy, which bloom twice a-year, they do not exceed in depth and purity of odour those which illuminate our English gardens. The sweetness of the flowers of England may be understood by a reference to our English poetry, which it seems to pervade with a subtle and delicate breath, like the perfume that clings to the vase after the posy has been removed. There are numerous images employed by our poets which could never have suggested

themselves to any but those fortunate bards who lived in a land of dewy and fragrant blossoms.

Let us now consider the *structure* of the flower. Of how many parts is it composed? Primarily, it consists



FLOWERS DISSECTED.

a, *Pistils.* b, *Stamens.* c, *Calyx.* d, *Petals.*

of "whorled leaves" placed on a short axis called the *thalamus* or *torus*—the marriage-bed or couch of the flower. Of these whorls, or twisted rings, there are generally four:—

1. The outermost, called the *calyx*, or cup;
2. The second, called the *corolla;*
3. The *stamens;* and,
4. The innermost, called the *pistils.*

Each of these whorls is made up of several parts, which, like leaves, follow a law of alternation; the organization of a flower being marked by as severe a simplicity and as perfect an order as the disposition and movements of the bright planetary bodies of the firmament. Take, for an example, the flower of the *crassula rubens:* * first, we find in it a calyx, composed of five equal pieces arranged in a whorl; second, a corolla, also of five pieces, but these

* Professor Balfour.

so placed as to correspond to the intervals of the calyx; thirdly, five stamens, which occupy the spaces between the parts of the corolla; and, fourthly, the five parts of the pistils, which follow the same exquisite harmony of arrangement. In some flowers, the parts are collocated by three, in others by fours and sevens; but the most admirable symmetry is invariably observed. It is not always so easy to trace, however, as in the *crassula rubens*, owing to the metamorphoses which, from various causes, some flowers undergo.

Of the four whorls which I have described, two, the calyx and the corolla, are also called *floral envelopes;* and the two inner, the stamen and pistil, *essential organs*—the organs of reproduction—without which the blossom would cease to be.

Plants in which both calyx and corolla are present, botanists designate *Dichlamydeous* (δὶς, and χλαμύς), or twice-covered; when one or the other is abortive, the flower is either *Monochlamydeous* (μονὸς), or single-covered, having a calyx only; or *Achlamydeous* (α, privative), that is, naked, having only the essential organs, and no floral envelope.

As I am not attempting in this little volume a botanical treatise, it seems sufficient to add to the foregoing explanation that the leaves of the calyx are called *sepals*, and are usually of a greenish colour. Sometimes, however, as in the fuchsia and tropeolum, they are coloured; in which case they are called *petaloid*. The leaves of the corolla we name *petals*. In these reside the bright colouring and Sabæan fragrance of the flower. The colouring matter resides in cells, and wholly differs from the colouring matter (*chlorophylle*) of the leaves.

The *stamens* spring up from the *thalamus* or *torus* within the delicate petals of the corolla, forming one or more whorls (or verticils), which, taken as a whole, constitute the male organs of the plant. For almost every flower is of two sexes; male and female living together in perfect and harmonious union. When they are below twenty in number they are said to be *definite;* when they exceed twenty, *indefinite* or *polyandrous.* Flowers are classified according to their stamens: a flower with one stamen is *monandrous* (μονος, and ανηρ); with two, *diandrous;* with three, *triandrous;* with four, *tetrandrous;* with five, *pentandrous;* with six, *hexandrous;* with seven, *heptandrous;* with eight, *octandrous;* with nine, *enneandrous;* with ten, *decandrous;* and with twelve, *dodecandrous.* As a matter of scientific classification these terms are useful; but the reader will be delighted to remember that even without a knowledge of them it is possible to learn much of the properties, and, at all events, to enjoy the exquisite beauties, of earth's fairy children—the "nurslings of the skies."

Every stamen consists of two parts: the *filament*, stalk or fibre, and the *anther*, or broader portion, which corresponds to the folded blade of the leaf, and contains a powdery matter called *pollen.* This is the reproductive substance, or seed, of the flower, with which the pistil is in due time fertilized. Its grains vary from $\frac{1}{300}$ to $\frac{1}{700}$ of an inch, or even less, in diameter, and are generally of an ellipsoidal form.

Of the pistil it is only needful to observe that it forms the centre or axis of the flower, and is encircled by the stamens and floral envelopes, like some queenly beauty

surrounded by her guards and courtiers. It is the female organ (*gynæcium*) of the plant, and, after flowering, is changed into the fruit, and contains the seeds. It consists of two principal parts: the *ovary*, or *germen*, which is the receptacle of the young seeds, and the *stigma*, a cellular secreting body, sometimes, as in the tulip and poppy, resting on the ovary, and designated *sessile;* sometimes, elevated on a stalk or style. Like the other whorls, the pistil is made up of one or more modified leaves, named *carpels*.

Most flowers expand in the morning and close in the evening; their opening and shutting being regulated by the conditions of light and moisture, and also, if we may use the expression, by *habit*, for a flower will open daily at almost the same hour and minute. Not a few remain obstinately closed in dull and rainy weather, like the *anagallis arvensis*, which has therefore been called "the poor man's weather-glass." Some, which I suppose are insensible to the action of light, do not expand their flowers until after sunset, like the night-blowing cereus. But this is a branch of my subject which my limited space precludes me from taking into consideration.

V.—THE TREE.

"Last,
Rose, as in dance, the stately trees, and spread
Their branches, hung with copious fruit, or gemmed
Their blossoms: with high woods the hills were crowned,
With tufts the valleys, and each fountain-side;
With borders long the rivers: that Earth now
Seemed like to Heaven, a seat where gods might dwell,
Or wander with delight, and love to haunt
Her sacred shades." MILTON

WHAT would Earth be without its "shadowy groves," its rich luxuriant woodlands, its copses musical with the hum of insects and the song of birds, and its deep masses of sombre forest? To understand how great would be the loss, in an æsthetic sense—how infinite a source of beauty would be closed up—if we were deprived of the graceful birch, and the solid elm, the delicate ash, and the patriarchal oak, go into the fenny districts of England, and observe how bare, and cold, and loveless is the landscape! Were there no trees I think the artist's and the poet's occupation would be gone. Natural scenery is indebted to them for so much of its grace as well as sublimity that their absence would oppress us with a keen feeling of desolation. Consider how they soften the rugged outlines of the mountains, how they relieve the monotony of the "level waste," how they enrich the low

meadow-bank of the rolling river, how they lend depth and shade to the naked glen! With what delight, after traversing an open expanse of sunlit mead, the traveller sees before him a bit of leafy woodland, winding under a

A BIT OF WOODLAND.

glorious umbrageous arch of oak and elm; or dwells, with rapt eye and grateful heart, on some such beautiful picture as our greatest living poet has painted:—

> "The tall dark pines, that plumed the craggy ledge
> High over the blue gorge, and all between
> The snowy peak and snow-white cataract
> Fostered the callow eaglet—from beneath
> Whose thick mysterious boughs in the dark morn
> The panther's roar came unmuffled."

How terrible would be the gloom of Earth if no such scene diversified its "roundness" as the following:—

"..... Methought that I had wandered far
In an old wood: fresh-washed in coolest dew,
The maiden splendours of the morning star
Shook in the steadfast blue.

"Enormous elm-tree boles did stoop and lean
Upon the dusky brushwood underneath
Their broad curved branches, fledged with clearest green,
New from its silken sheath.

"..... Growths of jasmine turned,
Their humid arms festooning tree to tree,
And at the root through lush green grasses burned
The red anemone." *

And what images of beauty we should lose if our poets could not seek their inspiration among the forest glades and musical woods, where the embowering trees at times recede, and open up a little space of green expanse, checkered by the sunlight and the shadow!

"More dark
And dark the shades accumulate—the oak,
Expanding its immense and knotty arms,
Embraces the light beech. The pyramids
Of the tall cedar overarching, frame
Most solemn domes within, and far below,
Like clouds suspended in an emerald sky,
The ash and the acacia floating hang
Tremulous and pale.....
..... Through the dell
Silence and twilight here, twin-sisters, keep
Their noonday watch, and sail among the shades,
Like vaporous shapes half-seen." †

In truth, the grove and the forest are essential parts not only of the grandeur but of the beauty of nature, while the trees themselves, considered separately, are among the most interesting and sublimest of the divine works.

For example: they are distinguished by their height,

* Tennyson. † Shelley.

their size, and their strength. The *Wellingtonia gigantea* attains an altitude which man's proudest buildings have never reached. The famous chestnut-tree of Mount Etna spreads its branches over so wide an area that a company of horsemen could encamp conveniently beneath them. I have myself seen in England vigorous green elms, full of life and sap, which measured between twenty and thirty feet in girth. As for strength, you will see the Alpine mountain-sides clothed with rich woods of pine and fir, which steadfastly resist the avalanche of snow and ice that sweeps before it like dust the crowded village. You will find the forest oak braving for a thousand years the storms of winter, and standing strong and erect before the gale which has toppled over spire and tower.

In respect to longevity, no animal can presume to cope with the living trees. The patriarchs of the forest laugh at history; they were planted by the hand of Nature before men began to record in writing the events of the passing years. Who shall presume to define the age of some of the hoary trunks which still rear their stalwart frames in the depths of the American wilderness? In our own country there are many which serve to link the present with the past, which were witnesses of the fierce struggle between Norman and Saxon, which were venerable with years when hunted Roundhead or Cavalier often found shelter among their branches. The King's oak at Windsor is twenty-six feet in circumference, and was a favourite with William of Normandy, it is said, when he first enclosed the forest. Of the Winfarthing oak at Diss, the story is told that it was a greybeard even at the epoch of the Conquest. In girth, a foot or two above the

ground, it measures seventy feet. The famous Ankerwyke yew must have been two centuries old when John signed Magna Charta in the adjacent meadow of Runnimede. Near Croydon there are oaks which may probably have seen the glint of the Roman spears as the stout legionaries wound their way through the glades of the Andredes-weald. Some years ago there flourished at Fountains Abbey a yew, under whose branches the monks had been wont to take shelter from the rain, while their abbey was being erected in 1133. Of three other English yews satisfactory evidence exists that they attained the respective ages of 1287, 2558, and 2880 years. From De Candolle I borrow the following figures in illustration of the longevity of trees :—

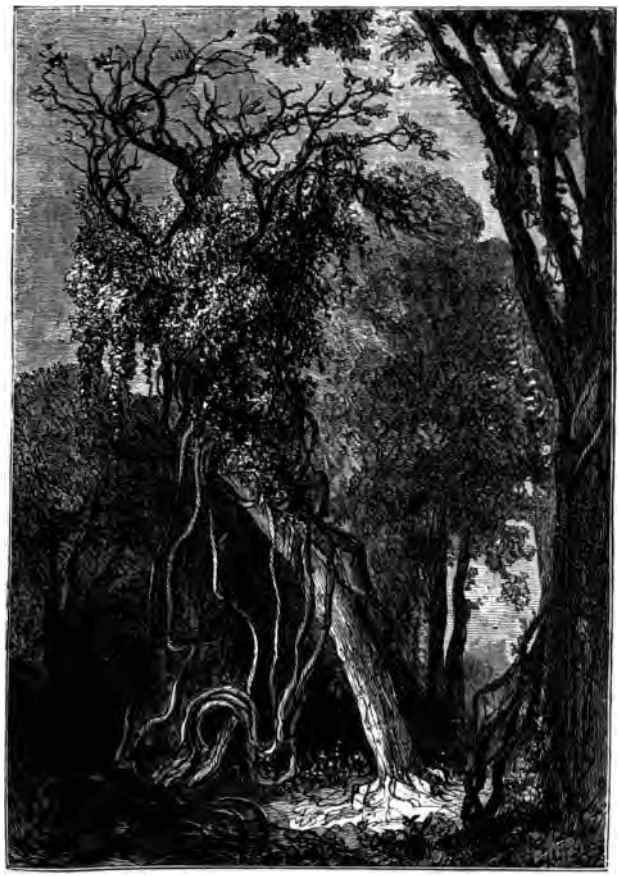
HOARY TRUNKS.

Elm	335 years old.	Ivy	450.
Limes	1076, 1147.	Oriental Plane	720
Cedar of Lebanon	800	Olive	700.
Oaks	810, 1080, 1500.	Orange	630.
Cypress	350.	Larch	576.

The famous Baobab of the Cape de Verde Islands is, however, the most remarkable instance. There seems reason to believe that it attained the astonishing age of 5150 years. Even in its decay, it measured 109 feet in circumference.

It is unnecessary to remind the reader that each climatic zone of the earth has its separate genera of trees, and that to look for an oak in the hot deserts of Nubia would be as absurd as to search for a violet on the frozen summit of Mont Blanc. This is the great law of nature: a place for everything, and everything in its place. In northern regions the forests are composed of coniferous trees, as pine and fir, whose pyramidal shape is well adapted for throwing off the burden of snow imposed upon them by the winter storms. In the Tropic forests the trees mostly belong to the palm tribe, which need the full ardour of the sun to develop their vitality and mature their fruit. In these luxuriant woods, moreover, the grasses which under a cold northern sky scarcely peep above the surface of the ground, rise into lofty trunks; some, like the bamboo, being sixty feet in stature. And a wealth of creeping plants twines around and about them; a labyrinth of climbers, epiphytes, and parasites, through whose close meshes it is with difficulty the traveller makes his way.

It is a curious fact that the primary form of all trees is the cone—that is, the form of all others best adapted to secure solidity, strength, and power of endurance. All young trees preserve a conical outline, though, as they grow older, many of them—as, for instance, the oak and beech—depart from their original pattern by putting forth a number of horizontal branches, until they ripen



LIANAS, OR TROPICAL CREEPERS.

into a graceful dome of foliage. The pine, however, is from first to last *a cone;* as it is called upon to resist the most violent storms, it wastes little of its strength upon its

PINES (*Pinus Sylvestris*).

boughs, but devotes itself, as it were, to the perfection of its stem, which, in the Scandinavian forests, sometimes grows to a height of 200 feet.

The pine is, perhaps, the most beautiful, the most perfect of all the trees of the forest. It is, in some respects, the noblest, for it flourishes among the grand solitudes of earth, on the mountain-top, on the wind-beaten crag, in the silent wilds of the far Polar regions. "Its character and glory, therefore," as an eloquent writer (Mr. Ruskin) remarks, "consists in its right doing of its hard duty, and forward climbing into those spots of forlorn hope where it alone can bear witness of the kindness and presence of the Spirit that cutteth out rivers among the rocks, as it covers the valleys with corn; and

there, in its vanward place, and only there, where nothing is withdrawn for it, nor hurt by it, and where nothing can take part of its honour, nor usurp its throne, are its strength, and fairness, and price, and goodness in the sight of God to be truly estimated."

The pine is peculiarly adapted for the hard but noble work it is called upon to do. It has to flourish in a rocky soil, and, therefore, instead of extending its roots deeply, in a vertical direction, it spreads them horizontally, under and over the ground, to which they cling with a firm grasp through their strong and knotty fibres, and so anchor their trunk securely in the most exposed and perilous situations. It is protected from the cold by its thick, tenacious bark, and by the heat-giving resins which permeate its entire structure. On its northern side, moreover, it is wrapped in a covering of warm gray lichens, and in the direction of the prevailing storms you will always find its bark is roughest and thickest. Of its vast utility it is almost needless to speak.* The pine-forests attract and condense the passing clouds, and gather up the fleeting vapours, until from bough and branch they fall in fertilizing drops, are absorbed by the humid mossy soil,

* A remarkable instance of the effect of pine-trees on the soil in which they grow has been published (we learn from a contemporary writer in *Chambers's Journal*) in the Woods and Waters Reports of the north of France. A forest near Valenciennes, comprising about eighteen hundred acres of scrub and stunted oak and birch, was grubbed up in 1843, and replaced by Scotch firs (*Pinus sylvestris*). The soil, composed of silicious sands mingled with a small quantity of clay, was in some places very wet; it contained two or three springs, from one of which flowed a small stream. The firs succeeded beyond expectation, and large handsome stems now grow vigorously over the whole ground. It was in the early stages of their growth that the curious effect to which we allude was noticed. The soil began to dry; the snipes that once frequented the place migrated to a more congenial locality; the ground became drier and drier, until at last both springs and stream ceased to flow. Deep trenches were dug to lay open the sources of the springs, and discover

and accumulating in secret springs and reservoirs, go forth, through the valley and the glen, to fertilize and bless the thirsty earth.

The propagation of trees is an interesting subject, and one whose study cannot but fill the devout mind with sentiments of awe and admiration. What is the landscape before us?

> "The forest primeval! The murmuring pines and the hemlocks,
> Bearded with moss, and in garments green, indistinct in the twilight,
> Stand like Druids of eld, with voices sad and prophetic,
> Stand like harpers hoar, with beards that rest on their bosoms." *

But how was this forest planted! How were its pines and hemlocks fixed in their present positions? That they sprung from tiny seeds, as a great event may always be traced back to an insignificant cause, we all of us know, but how were these seeds distributed? Well: in many cases the seed is borne hither and thither on the wings of the wind, for which purpose they are furnished with certain downy appendages, like pinions. I may here bring forward a striking illustration:—The brown linnet, when feeding on thistle seed, perches on the top of the stalk, and tears the downy head asunder, in order to reach the seeds which are attached to the receptacle. During this

the cause of their drying up; but nothing was found except that the roots of the firs had penetrated the earth to a depth of five or six feet. Borings were then made; and six feet below the source of the spring, a bed of water was met with of considerable depth, from which, it was inferred, the spring had formerly been fed. But in what way its level had been lowered by the action of the firs could not be determined, and is still a matter of speculation. But the fact remains, and may be utilised by any one interested in tree culture. For years it has been turned to account in Gascony, where the lagoons that intersect the sandy *dunes* have been dried up by planting the *Pinus maritimus* along their margin. Hence we may arrive at the conclusion, that while leafy trees feed springs and maintain the moisture of the soil, the contrary function is reserved for spine or needle-bearing trees, which dry the soil and improve its quality.

* Longfellow.

act, many of the grains are loosened, and carried away by the breeze to places far distant from the parent stem, the bird being in this instance the indirect disseminator of the thistle. Were the head not rent asunder after this fashion, it would most probably become soaked with the rains of winter, and fall down only a few inches from the original stalk, instead of being transported, as it frequently is, across many miles of country. What is here told of the linnet may be witnessed in any "thistlery" on a fine September day, when the birds are feeding in flocks, and scattering the down in every direction. The greater part of the seeds is, of course, devoured by them, but a considerable number also escape. Of this fact the bird is well aware, as it frequently gives chase to the stray ones as they are ravished afar by the breeze.

The heavier seeds are also transported in this manner by the force of violent gales or hurricanes.

Another agency in the distribution of seeds is water. The torrent, or mountain-stream, sweeps down into the valley the seeds which accidentally drop into it, or which it washes from its banks when it suddenly overflows them; the river as it rolls across the plain deposits here and there the vegetable matter which it has carried off from remote localities; and the seeds conveyed by either of these great agencies only need to alight upon a favourable soil in a suitable situation to embed themselves, germinate, take root, and flourish, preparatory to their full development as plants or trees. It is thus that the cocoa, planted on the coral island, hemmed round by melancholy seas, becomes the progenitor of a young palm-grove which converts the barren rock into a very Eden.

Among all the circumstances, more or less marvellous, that invest the tree with a peculiar attraction to the thinker, I know of none more curious than the circulation of the sap. Consider the girth and bulk, and astonishing ramification of branches, twigs, and leaves, and not less astonishing ramification of roots and fibres underground, which make up that majestic work of God, a forest tree; and then consider how wonderful a thing it is that, during the greater part of the year, a stream of life and vigour drawn up from the soil is continuously flowing through branch and twig and leaf, through root and fibre, like the blood through the veins and arteries of man, quickening, strengthening, and inspiring! It has justly been remarked* that in the higher animals, with a circulation that is both shorter and less opposed to gravity, there exists a central heart to pump, and elastic vessels to convey the blood; but the tree has no such reservoir of force, and its vessels are mostly stiff and tenacious tubes. It is not, therefore, very exactly known by what power the sap is conveyed from the underground rootlets and fibres to the topmost leaf on the topmost bough. Certain chemico-vital agencies, not easily explained, are doubtless engaged in the task; and more particularly that marvellous faculty termed *endosmose*, in virtue of which a thick fluid attracts a thin fluid through a cellular membrane or partition.

* Dr. Chaplin Child, *Benedicite.*

VI.—THE FOREST.

"One vast mass,
mingling shade."

SHELLEY.

THERE are few of us insensible to the beauty and the joy of woods, the charms of leafy groves, and the mysteries of venerable forests. There are few whose ears are deaf to the music of whispering leaves, when the breeze wanders from glade to glade, and avenue to avenue, like a spirit in search of some sister loved and lost. There are few, I imagine, whose mind does not rejoice in the glory of colour which steeps the woodland in lustre; the bright emerald green of the spring-time; the riper hues of summer; and the purple and gold and crimson in which autumn rejoices, like a king in his regal pomp. There are few who love not the forest gloom, and the long arcades of ancestral trees, and the sense of awe and loneliness which seems to belong to their silent depths, recalling the old myths of the poets, the legends of fabulous Arcady, and the days of oreads and hamadryads, or gnomes, elves, and fays. Minstrel and painter have found an inspiration in woodland scenery from all time—from the days of Theocritus to those of Tennyson;

from the days of Poussin and Salvator Rosa to those of Turner and Creswick. The forest, moreover, has ever been the favourite region of charm and spell. It figures in the fairy song of Ariosto, in the fantastic poem of Spenser; it is rich with the legendary superstitions of Germany, and the folk-lore of our English land. All that is sublime and inspiring in our thoughts or dreams is naturally associated with the forest; and into its dim recesses the philosopher retires to meditate, the savage to worship his self-conceived gods—youth to indulge in its vagrant fancies, and love to repose in radiant visions. "Mark the sable woods," exclaims the poet,—*

> "Mark the sable woods
> That shade sublime yon mountain's nodding brow,
> With what religious awe the solemn scene
> Commands your steps! as if the reverend form
> Of Minos or of Numa should forsake
> The Elysian seats, and down the embowering glade
> Move to your pausing eye."

The interest and wonder of the forest, moreover, are inexhaustible. Nature scatters abroad her wealth with a hand that is never weary. She has no recourse to copying, to servile imitation; the Mind that conceived this mighty Whole can no more stint its glorious ideas than the clouds cease to drop moisture. One might spend one's life in the forest, and daily find some fresh theme for pleasant meditation, some new food for a graceful curiosity. The fir woods that hang upon the slopes of the Scottish mountains; the rich deep masses of beech that clothe the round outlines of the Chiltern Hills; the patches of venerable trees that still linger within the cir-

* Akenside.

cuit of the New Forest—trees which flourished in stalwart vigour when far below

> "The Roundhead rode,
> And hummed a surly hymn;"—

all these have a charm, a value, and an interest, which would occupy the mind for years before it could fully recognize all their various and ever-varying relations.

But it is not of English trees,—neither of the famous oak, inseparably associated as it is with our national glories; nor of the stately elm, where the rook loves to build his substantial nest; nor of the graceful ash, the last to unfurl its banners of bright green, and the first to fold them before the coming winter; nor of the yew,

> "Beneath whose sable roof
> Of boughs, as if for festal purpose, decked
> With unrejoicing berries, ghostly shapes
> May meet at noontide;" *

it is not of the chestnut, which welcomes May with so radiant a burst of blossoms; nor of the willow, drooping low over the silent grave; nor of the quivering aspen, nor the far-spreading sycamore, that I am thinking now. With these dear old glories of our native land—these familiar friends of our boyhood, in whose embracing arms we have often taken rest—we need not now concern ourselves; but, going "further afield," and venturing into strange tropical regions, where Nature riots in a luxuriance all unknown to our temperate climes, let us dwell for awhile on the rarer and more curious aspects of woodland scenery.

Has the reader, I wonder, ever attempted to form any

* Wordsworth.

AN ENGLISH WOOD.

idea of what a *tropical* forest is? An English grove or a Highland wood is, as I have said, full of attractiveness and interest; very impressive in its grave and tranquil

A Tropical Forest.

beauty; but to the artist's eye it can never compare with a tropical forest, all aglow with intense colour, and full of exuberant life! The depths of Borneo or Ceylon; the primeval masses which for hundreds of miles clothe the hot reeking lowlands of the Amazons; or those Brazilian wildernesses, the "virgin forests," whose unfathomable depths have never been disturbed by the foot of man since the earth first rose out of chaos,—no tongue can tell, no pen can describe, their marvellous and all-abounding splendours! Huge trees, soaring to the height of one hundred and one hundred and fifty feet; trees, whose giant stems shine like the columns of some mystic natural temple; trees whose branches are thickly embowered in softest mosses and the most dazzling foliage, whose closest shades are haunted by myriads of rare birds and insects, and whose far-reaching arms are interlaced by bands of glittering climbers, while scores of parasites—

> "Like restless serpents, clothed
> In rainbow and in fire"—*

twine around their gray trunks in strict embrace, and adorn their colossal majesty with blooms, "minute yet beautiful." Trees, and climbers, and parasites; grasses, rich mosses, and ferns almost as tall as trees; these spread over many a league of unknown and unexplored ground, along the banks of mysterious streams, into the heart of inaccessible valleys! Trees everywhere: weaving their branches together so closely, that even at noon the forest-depth is obscure as twilight; and so intertwining their parasitical overgrowth, that the traveller finds himself at

* Shelley.

all points confronted by an insuperable barrier! * Trees everywhere: some with long, narrow, pendulous leaves—others with fan-shaped leaves; these with leaves drooping like a warrior's plume—those with leaves sharp and erect like a soldier's spear! Trees everywhere: some tall and stately as a Grecian pillar; others bent and gnarled, as if Time had treated them sorely. Trees, and thorny shrubs, and flowering shrubs, and creepers, and immense ferns, both climbing and epiphytous,—trees around you and above you, until, to the confused eye, all nature seems transformed into one vast and inextricable wilderness of leaf and blossom;—such is a tropical forest.

Mr. Bates, in his Brazilian travels, visited the "forest-country" around Pará—that is, an unbroken forest extending three hundred miles southward and eastward of that city. He never succeeded in penetrating into its interior, but frequently explored the outskirts, and this is the scene he was wont to wonder at:—

"The ground was thickly carpeted with Lycopodiums,† but also encumbered with masses of vegetable *débris* and a thick coating of dead leaves. Fruits of many kinds were scattered about, including numerous species of beans, some of the pods a foot long, flat and leathery in texture, others hard as stone. In one place might be seen a quantity of large empty wooden vessels; such, at least, they appeared to be, but in reality they had fallen from the Sapucaya

* In descending the streams between the Orinoco and the Amazon, says Humboldt, we often tried to land, but without being able to step out of the boat. Towards sunset we sailed along the bank for an hour to discover, not an opening, since none exists, but a spot less wooded, where our Indians, by means of the hatchet and manual labour, could gain space enough for a resting-place for twelve or thirteen persons.

† Order *Lycopodiaceæ;* club-mosses.

tree. They are called *Monkey's Drinking-cups* (Cuyas de Macaco), and are the capsules of the nuts sold under this appellation in Covent Garden Market. The top of the vessel is pierced with a circular hole, in which a natural lid fits easily. When the nuts ripen this lid becomes loosened, and down falls the heavy shell with a crash, scattering the nuts over the ground. The tree* which bears this extraordinary burthen is of immense height. It is closely allied to the Brazil-nut tree,† whose seeds are likewise enclosed in large wooden vessels, but these are without lids, and fall entire to the ground. It is at least 120 feet high, rising to the noble stature of 100 feet before it throws off any branches. From twelve to twenty of these sweet edible nuts lie in a pod. The monkeys are very partial to them, and some will patiently sit for hours hammering at a capsule with a stone, in order to open it; while others, as soon as they have succeeded, rush to the spot, and purloin as many as they can. The natives assail the quarrelling party with stones, a proceeding which incites the monkeys to revenge themselves by a discharge of nuts. By this means the Indians load their boats without trouble, and the monkeys are left to make a fresh foray."

In his forest wanderings, Mr. Bates was especially attracted by the colossal trees. He says that, "on the whole, they had not remarkably thick stems; the great and uniform height to which they grow without throwing off a branch is a much more noticeable feature than their thickness; but at intervals you meet with a veritable giant. Only

* Lecythis Ollaria (order *Lecythidaceæ*).
† Bertholletia Excelsa (same order).

one of these huge patriarchs of the woods can flourish within a given space; it monopolizes the domain, and none but humble individuals can nestle within its shadow." The cylindrical trunks of many of the larger trees were from twenty to twenty-five feet in circumference. Von Martius, another Brazilian traveller, mentions having measured trees in the Pará district, belonging to various species (Symphonia coccinea, Lecythis spirula, and Cratæva Tapia), which were fifty to sixty feet in girth at the point where they become cylindrical! The height of the vast column-like stems, from the ground to their lowest branch, could not be less than 100 feet. The total height of the Pao d'Ano* and the Massaranduba, stem and crown together, may be computed at 180 to 200 feet. Where one of them stands, the vast canopy of leafiness rises above the other forest trees, like a domed cathedral above the minor buildings of a city.

A very curious feature in those trees is the growth of buttress-shaped projections around the lower part of their stems. The spaces between these buttresses, which may be compared to thin walls of wood, form spacious chambers, like stalls in a stable; some of them large enough to hold half-a-dozen persons. "Their purpose," according to Mr. Bates, "is as obvious at the first glance as that of the similar props of brickwork raised for the support of a high wall. They are not peculiar to one species, but are common to most of the larger forest trees. Their nature and manner of growth are explained when a series of young trees of different ages is examined. It is then seen that they are the roots, which have raised themselves ridge-like

* Order *Bignoniaceæ*.

out of the earth; growing gradually upwards as the increasing height of the tree required augmented support. This wonderful provision has been designed by the Creator to sustain the massive crown and trunk in these crowded forests, where the lateral growth of the roots would be rendered difficult by the number of competitors."

Among other remarkable inhabitants of the Brazilian wilderness, we may name the lofty Moira-tingu,* the

THE COW-TREE (*Galactodendron utile*).

Samaüma,† and the Massaranduba, or cow-tree.‡ The Eriodendron Samaüma, or silk-cotton tree, holds in the New World the same position as the Bombyx in the Old. It rises to an enormous stature without branches, and then spreads out a glorious dome of foliage. The bark is light in colour; and the capsule-pod contains a large quantity

* Order *Leguminosæ*, tribe *Mimoseæ*. † Order *Sterculiaceæ*.
‡ Order *Urticaceæ*.

of down, of a brown tint, and exquisite silky softness. The Massaranduba is also called the Palo de Vacca, the Arbor de Lacte, the Galactodendron utile, or the *Cow-tree*. Its bark furnishes an abundant supply of milk as pleasant to drink as that of the cow. If exposed to the air it thickens into a glue, which is excessively tenacious, and often employed to cement broken crockery. The tree has a wild strange appearance, owing to its deeply-scored, reddish, and rugged bark, a decoction of which is used as a red dye for cloth.

Did our readers ever hear of the Pashiúba, or bulging-stemmed palm?* It is not one of the tallest kinds, for its height, when full grown, seldom exceeds 40 feet; the leaves are somewhat less drooping, while the leaflets are broader than in other species; but if less beautiful, it is perhaps far more remarkable. Its roots grow above ground, radiating from the trunk at an elevation of ten or twelve feet, so that the tree seems to be supported on stilts; and when it is old, a person can stand upright amongst the roots with the perpendicular stem soaring far above his head. About midway this stem bulges out in a circular swelling, to which the tree owes its distinctive name. The root closely resembles straight rods, but they are studded with stout thorns, whilst the trunk of the Pashiúba is perfectly smooth.

Another picture of a tropical wilderness, as it encroaches on the very suburbs of the Brazilian towns, is given by an eminent living naturalist. He tells us that while walking along the shady pathways, and admiring each successive view, he has often longed for suitable language to

* Iriartea Ventricosa.

express his ideas. Epithet after epithet has seemed too weak, when he has sought to convey to those who have not visited the intertropical regions the sensation of delight which his own mind has experienced. The land he describes as one great, wild, untidy, luxuriant hothouse, made by Nature herself, but taken possession of by man, who has studded it with gay houses and formal gardens. How keen would be the desire in any lover of nature to behold, if it were possible, the scenery of another planet! Yet to any person in Europe it may truly be said that, at the distance of two or three thousand miles from his native soil, the glories of another world are opened up to him. Yet so manifold are the beauties, and so various the characteristics of the scene, it becomes impossible to fix any definite impression of them upon the mind. The form of the orange-tree, the cocoa-nut, the palm, the mango, the fern-tree, the banana, may remain clear and separate; but the thousand charms and graces which unite them into one perfect scene must fade away; or, at most, will leave, like a tale told in childhood, a picture full of indistinct but most beautiful figures.

So much for the forest in its tropical development. But before I quit this general consideration of the Tree, I would fain turn once more to the woodland scenery of the North.

A pine forest is one of the grandest scenes imaginable, and from its silence, its solitude, its dim mysterious vistas and shadowy avenues, it is also one of the most impressive. You seem to be tracing the airy colonnades of a palace of the giants, or of some deserted city of the past, which is no longer tenanted by the living, and which, if

PINE FOREST.

the spirits of the dead ever frequent it, 'tis without a sound or murmur. Through those long-drawn aisles come occasional flashes of sunlight, kindling them into a wonderful

and almost incredible radiance—touching each drooping leaf with a Midas-touch, and converting its wrinkled surface into burnished gold—brightening the gray moss and lichen which clothe each hoary trunk—and revealing the wild-flowers that nestle softly in the dells and hollows of the greensward. Just as our work-day life is thrown into strong contrast by the occasional gleams of beauty and visions of future happiness which haunt the dreamy brain, so is the wonted twilight of the forest made more evident by these passing bursts of the glory of the sun. And this alternation of sunshine and shadow adds in an inconceivable degree to the sublime influence of the "murmurous pines."

"Beautiful," says an eloquent writer,* "beautiful is the pine forest in all seasons: in the sweet fresh spring, when the gnarled boughs are penetrated and mollified by the genial wind and cheerful sunshine, and, glowing with young life, burgeon in tassels and fringes of the brightest green and cones of the mellowest purple. Beautiful, too, in the happy summer-time, when the deer finds a cool retreat in its furthest recesses, and the radiance of a golden heaven falls in tremulous gleams on the still woodland pool, or checkers with rare designs the yielding mosses and clustering ferns. Beautiful, too, in melancholy autumn, when its eternal freshness is so delightful a relief after the eye has grown sad and aching with contemplation of the change that the waning months have wrought in the aspects of external nature. And beautiful, above all, in the mid-winter, when a glorious burden of snow rests on the spreading branches, and every leaf, and stem, and

* Rev. Hugh Macmillan.

bough are wreathed with fairy festoons of the most exquisite design.

"Beautiful is the pine forest in the hour of calm,

'When all the forest leaves seemed stirred with prayer,'

and the prevailing silence is the more keenly felt because occasionally broken by the jubilant song of a passing bird. Beautiful in the agony of the storm, when a thousand strange and haunting voices echo through glade and avenue, and the grand old trees wrestle with the wind, as Jacob of old wrestled with the angel.

"I do not wonder," as Mr. Macmillan says, "that the northern imagination in heathen times should have invested it with awe and fear as the favourite haunt of Odin and Thor; or that, in after-times, its long rows of trunks, vanishing in the dim perspective, should have furnished designs for the aisles of Christian temples; and the sunset, streaming through its fretted branches, should have suggested the gorgeous painted window of the cathedral. It seems, most truly, a place made for worship; all its sentiments and associations are more or less sacred and solemn. Nature, with folded hands—to use Longfellow's fine expression—seems kneeling there in prayer. Assuredly it reminds us in various ways of the power, wisdom, and goodness of Him who thus spake by the mouth of His prophet: 'I will plant in the wilderness the cedar, the fir tree, and the pine, and the box tree together: that they may see, and know, and consider, and understand together, that the hand of the Lord hath done this, and the Holy One of Israel hath created it.'"

It is true, however, that even the pine forest has its

less poetical aspect. Lord Milton and Dr. Cheadle, in their graphic narrative of an expedition from the Atlantic to the Pacific,* across the Rocky Mountains, thus describe their experiences of the American wilderness :—" No one," they observe, " who has not seen a primeval forest, where trees of gigantic size have grown and fallen undisturbed for ages, can form any idea of the collection of timber, or the impenetrable character of such a region. There were pines and thujas of every size, the patriarch of 300 feet in height standing alone, or thickly clustering groups of young ones struggling for the vacant place of some prostrate giant. The fallen trees lay piled around, forming barriers often six or eight feet high on every side; trunks of huge cedars, moss-grown and decayed, lay half-buried in the ground, on which others as mighty had recently fallen; trees still green and living, recently blown down, blocking the view with the walls of earth held in their matted roots; living trunks, dead trunks, rotten trunks; dry, barkless trunks, and trunks moist and green with moss; bare trunks and trunks with branches—prostrate, reclining, horizontal, propped up at different angles; timber of every size, in every stage of growth and decay, in every possible position, entangled in every possible combination. The swampy ground was densely covered with American dog-wood, and elsewhere with thickets of the aralea, a tough-stemmed trailer, with leaves as large as those of the rhubarb plant, and growing in many places as high as a man's shoulder."

I cannot leave the pine, however, without once more calling the reader's attention to those characteristic qualities

* The North-West Passage by Land.

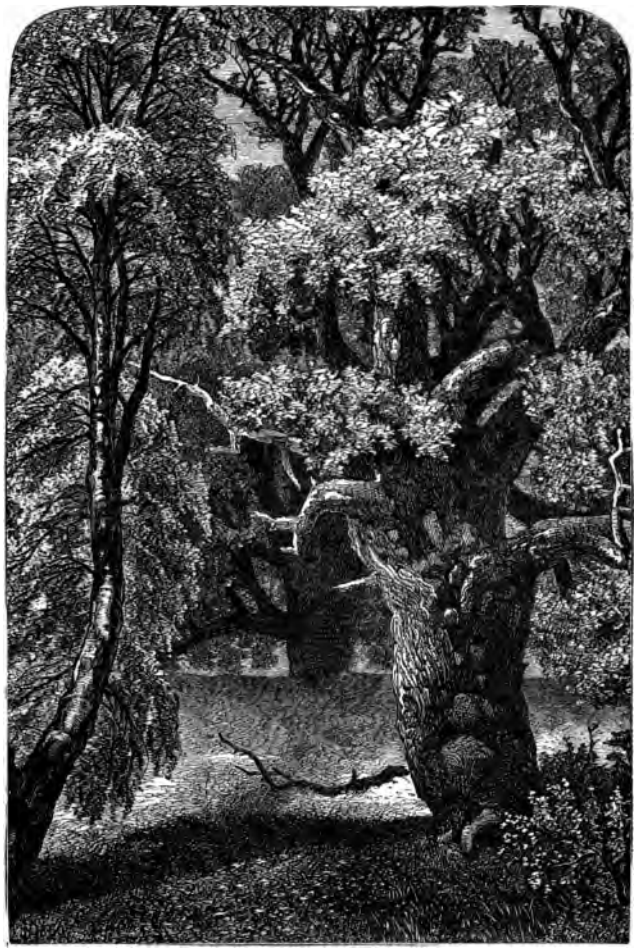
which make it the very type of beauty as it is, to my mind, the monarch of trees.

A great writer* has pointed out, as the two chief characteristics of the pine, its straightness and rounded perfectness.

"Other trees"—as he observes, with all that eloquence of expression which renders his criticisms, even when one does not agree with them, such delightful reading—"other trees, tufting crag or hill, yield to the form and sway of the ground, clothe it with soft compliance, are partly its subjects, partly its flatterers, partly its comforters. But the pine rises in severe resistance, self-contained; nor is it possible to stay long, without awe, under a great Alpine cliff, far from all house or work of men, looking up to its companies of pine, as they stand on the inaccessible juts and perilous ledges of the enormous wall, in quiet multitudes, each like the shadow of the one beside it—upright, fixed, spectral, as troops of ghosts standing on the walls of Hades, not knowing each other—dumb for ever. All comfortless they stand, between the two eternities of the Vacancy and the Rock; yet with such iron will, that the rock itself looks bent and shattered beside them—fragile, weak, inconsistent, compared to their dark energy of delicate life, and monotony of enchanted pride: unnumbered, unconquerable."

The second distinguishing quality of the pine is its perfectness. It is so exquisitely green, its trunk so finely rounded, its compactness is so remarkable, and there is such a harmony and completeness about its pyramidal mass of branch and foliage! Instead of being wild in

* Ruskin.



A Forest Glade.

expression, says Mr. Ruskin, it forms the softest of all forest scenery; for other trees show their trunks and twisting boughs; but the pine, growing either in luxuriant mass or in happy isolation, allows no branch to be seen. And not only is it softer, but in a certain sense it is far more cheerful than other foliage, because it throws only a pyramidal shadow. Lowland forest arches overhead, and checkers the ground with darkness; but the pine, growing in scattered groups, leaves the glades between emerald-bright. Its gloom is all its own; harrowing into the sky, it lets the sunshine strike down to the dew.

God be praised, thankfully and reverently, for the tree and the forest!

VII.—TREES USEFUL TO MAN.

"Those groups of lovely date-trees bending
Languidly their leaf-crowned heads,
Like youthful maids, when sleep descending,
Warns them to their silken beds."

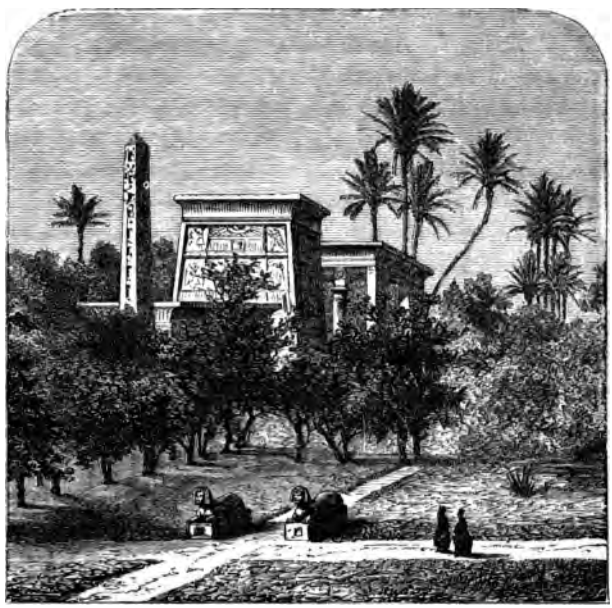
MOORE.

IN the book of travels of a recent writer,* I find the following description on a landscape on the Nile:—

He describes it as unable to bear the test of comparison with some of our English and Scottish scenery, or with that of Switzerland and Norway, Italy and Spain, France and Germany; yet as beautiful in itself, beautiful with a peculiar beauty. For though the strips of cultivated land, and the wider plains, are necessarily flat, seeing that they are annually inundated by the river, yet they are always backed by the red or yellow rocks of the desert; and these rocks, though rarely bold or grand, form a most picturesque background to our view, and from the contrast which their barren glowing heights present to the rich green of the alluvial soil, so marvellous in its fertility, stand out as broad gilt frames to relieve the colours of our picture, or as deep gold settings to enhance the brilliancy of our

* Rev. A. C. Smith, "The Nile and its Banks."

jewels. Then the broad stream of the old historic river is in itself a noble sight; the palm-trees with which its banks are often lined, and the villages clustering beneath them; the ruins of vast temples, which here and there stand out on the very verge of the desert; and the mighty pyramids, which are conspicuous in certain districts, combine to form a picture of strange and delightful charm.



ANCIENT GARDEN—EGYPT.

The palm,* which in this and similar landscapes plays so conspicuous a part, holds in the countries of the East a position not unlike that which in colder climes is oc-

* Order, *Palmaceæ*.

cupied by the pine. In the gardens of Egypt it forms one of their most graceful and usual ornaments. No other tree, indeed, is so well adapted to the conditions of soil and temperature, and the alternations of long periods of drought and moisture, which it has to undergo. No other tree could so conveniently minister to the wants of the inhabitants of those regions, where man, enervated and enfeebled by the influence of a burning sun and a scorching sky, is both unable and unwilling to labour strenuously for his maintenance. The denizen of a colder country is compelled to seek, from many different sources, the supply of his needs. His food he finds in the cereal grasses; his beverage in the "bearded barley," the tea of China, or the coffee of Demarara; his houses he builds of larch, and fir, and cedar; his ships of oak; he weaves his clothing with the products of the flax or the cotton plant; he makes his last home and habitation of elm. But the Egyptian fellah or Nubian peasant can satisfy his wants as well as his desires with one all-abounding and all-providing tree. The date palm yields him wine and oil and vinegar, farinaceous food and sugar, timber and ropes, mats and paper. The South Sea Islander is equally fortunate in the cocoa-nut palm, the graceful ornament and inexhaustible wealth of those fair coral isles which gem the bosom of the Pacific. It provides him with a grateful shade from the vertical sun; he builds his hut with its timber, and thatches the roof with its leaves. The cut sheath of the flowers distils a sweet liquid, which, by fermentation, speedily becomes the refreshing palm wine, so grateful and wholesome in a hot climate. From this liquor sugar is obtained by boiling, or vinegar, if it be exposed to

A CORAL ISLAND.

the air for a sufficiently long period. The nut is valuable as food, and indeed is the Polynesian's staff of life; it also supplies an oil, equal to that of almonds, which is extensively used in India. The strong fibrous husk is employed for numerous domestic purposes, and the shell itself for cups and goblets.*

But more: the palm also furnishes the islander with images of grace and loveliness, and, not to be too fanciful, with a music which may well awaken in the mind a responsive melody. The giddy mountain-heights of Tahiti, for instance, are adorned with vaporous arcades, through which the rays of sunshine glide like spirits. A solemn silence reigns among them, until, towards noon, the

* Humboldt.

sea-breeze rises, when a soft sweet murmur steals abroad upon the air, and each long quivering leaf contributes its note to the strain, which grows louder and deeper as the wind increases in force. At first, the tree only bends its leafy crest; but by-and-by its whole body waves to and fro, until, at evening, the entire mass of the forest rolls with a billowy motion like that of the sea, with a motion at once so graceful and majestic that words cannot describe it.*

Linné, the great botanist, has not inaptly called the tall and crested PALM TREES "the princes of the vegetable world," and wherever they bloom they enrich the landscape with their grace and majesty. The most perfect of the tribe have a tall cylindrical stem, which shoots upward from the earth, without knot or blemish, like an Ionic column; springing to an immense height, and yet so symmetrical that its slenderness conveys no idea of feebleness. The summit bears a crown of emerald green plumes, like a diadem of gigantic ostrich feathers; these are frequently twenty feet long, droop slightly at the ends, and rustle musically in the breeze. In the arid desert it forms an object of peculiar beauty, as it soars, erect and graceful, near some welcome spring of living waters, a landmark to the wayworn traveller; but to see it in all its glory you should visit the palm-groves of Tropical America, or Polynesia, and wander enchanted in their grateful shades. Under the natural screen which their thick green feathery branches supply, the orange and the lemon, the pomegranate, the olive, the almond, and the vine, flourish in wild luxuriance, and pour forth an abundance of luscious

* Hermann Melville.

(240) PALMS.
7

fruit. And while the eye is never weary of gazing on the glorious blossoms which brighten and adorn the scene, the ear is also ravished with the sweet clear melody of numerous birds, attracted to the palm-grove by its cool shadows, its fruits, and crystal springs.

The valley of the Amazons rejoices in an infinite variety of these beautiful trees.* Among them a foremost place must be given to the Fan-leaved,† which abound in the islets and on the banks of the mighty river and its tributaries. Their stems are huge smooth cylinders, three feet in diameter, and about a hundred feet high. Their crowns consist of enormous clusters of fan-shaped leaves, whose stalks alone measure seven to ten feet in length.

Nothing in the vegetable world, we are told, can be more imposing than this grove of palms. No underwood obstructs the view of the long perspective of towering columns, which forces on the spectator's mind the remembrance of the long-drawn aisles of Gothic cathedrals. The crowns, densely packed together at an immense height overhead, shut out the rays of the sun; and the gloomy solitude beneath, where every sound has a strange reverberation, can be compared to nothing so well as a solemn temple. In such a scene it is meet that the soul, "on Devotion's wing," should mount to God.

Humboldt has christened the Mauritia flexuosa the "Tree of Life." "It is the chief, almost the only nourishment," he says,‡ "of the unconquered nation of the Guaranis, at the mouth of the Orinoco, who skilfully stretch their mats—woven from the nerves of the leaves—from one

* H. W. Bates, "The Naturalist on the Amazons."
† Mauritia flexuosa.
‡ Humboldt, "Personal Narrative of Travels in Equatorial America."

trunk to another, and during the rainy season, when the Delta is inundated, live like apes on the tops of the trees."

These habitations are partially roofed with mud; the women light their household fires on a flooring of the same material; and the traveller, ascending the river at night, gazes astonished on the hundred spiral shafts of flame and smoke which seem kindled in the very air!

But not only with a habitation does the Mauritia supply these savages; it also feeds them. Before the flowers are developed, the trunk affords them a farinaceous pith, like sago; the sap provides wine and "the joys of Bacchus;" the fresh fruits, covered with scales like fir-cones, yield them nourishment, whether they eat them after the full development of their saccharine principle, or when they simply contain an abundant pulp.

The fruit was first brought to England by Sir Walter Raleigh. The tree does not attain maturity in less than 120 or 150 years.

The Assai palm * deserves mention on account of its edible properties. The fruit, which is perfectly round, and about as large as a cherry, contains but a small quantity of pulp, lying between the hard kernel and the skin. With the addition of water, the pulp forms a thick, violet-coloured beverage, which stains the lips like blackberries, and is universally drunk by the Indians of the Tocantins. The tree itself rises, without knot or blemish, to a great height. The outer part of the stem is as hard and as tough as horn; split into narrow plants it is used for the walls and flooring of the Indian huts.

A noble palm grows in the neighbourhood of San-

tarem, which the natives call *Bacába*.* It grows to a height of forty to fifty feet. The crown is of a shining glossy emerald-green, and of a singularly flattened or compressed shape; the leaves being arranged on each side in nearly the same plane. The fruit ripens towards the end of the winter, and the natives manufacture from it an agreeable liquor, by rubbing off the pulpy coat of the nuts and mixing it with water. The beverage resembles milk, and possesses a piquant nutty flavour. As the Bacába, on account of its smooth stem, is very difficult to climb, the natives, whenever they want to quench their thirst with its fruit, cut down, and thus destroy—with the wasteful thoughtlessness of all savages—a tree which has taken a score or two of years to grow.

The *Urucurí* † is another Brazilian or Amazonian palm, and one of singular beauty. It flourishes in immense groves under the crowns of the loftier forest trees; the smooth pillar-like stems being nearly all of equal elevation—forty to fifty feet; and the broad, finely-pinnated leaves interwoven above in a natural dome-like vault of ever-fresh greenery. The fruit, which in size and shape resemble the date, is never eaten by Indians. It is palatable, but not wholesome.

But still more celebrated in Tropical America is the widespread *Peach palm*,‡ called by the Tupé Indians the *Pupunha*. The English name would seem to allude to the colour of its fruit rather than to its flavour, which travellers contemn as "dry and mealy," or like a "mixture of chestnuts and cheese." Vultures devour it eagerly, and hover about the tree, when it is ripe, in noisy and quarrelsome flocks.

* Œnocarpus distichus. † Attalea excelsa. ‡ Gulielma speciosa.

The Pupunha is a noble ornament to the landscape, being, when mature, from fifty to sixty feet in height, and frequently as straight as a scaffold-pole. A bunch of ripe fruit is a sufficient load for a strong man, and each tree bears several of them. The nut, in good condition, is as large as a full-sized peach; and, if boiled, will bear comparison with an Irishman's delicacy—a mealy potato. In the neighbourhood of Egra, where the Pupunha is carefully cultivated, it is thus prepared for table, and eaten with treacle or salt. A dozen of the seedless fruits make, it is said, a good meal for a grown-up person.

It is astonishing to what a variety of uses the Amazonian Indians apply the palm. It provides them with house, food, drink, raiment, salt, implements, weapons, fishing-tackle, and even musical instruments. The rafters of their huts are formed, perhaps, of the straight and uniform palm called *Leopoldina pulchra;* the *Caraná* is brought into requisition for the roof; and the split stems of the *Iriartea exporiza* furnish the doors and frame-work. The wide bark which grows beneath the fruit of another species is woven into an apron. The comb with which many of the males adorn their heads is made from palm wood, and their fish-hooks from its spine. Caps for the head, and cloth for the loins, are manufactured from the fibrous spathes of the *Manicaria saccifera.* These, too, supply the native with his hammock and bow-strings. Various species of palms yield oil and edible fruit; from eight kinds an intoxicating liquor can be distilled; and from the *Jará assú*, by burning its small nuts, he procures a substitute for salt. From the spinous processes of the *Patawá* he makes his arrows, and arms himself with lances and harpoons from

the *Triatea ventricosa*. The long blow-pipe through which he hurls the envenomed dart at birds and animals comes from the *Setigera* palm; from the stems of various trees he fashions the harsh, bassoon-like, musical instrument employed in his "devil-worship;" and, finally, the great woody spathes of the *Maximiliana regia* provide him with cooking-vessels.

TALIPAT PALM (*Corypha umbraculifera*).

In Ceylon and Malabar one of the principal palms is the remarkable *Talipot*, *Talipat*, or Umbrella-bearing palm,* which frequently attains the extraordinary elevation of 100 feet; is straight as a giant's spear; five feet in circumference at the base, and tapering towards the summit, where it terminates in a magnificent crown of enormous palmate plaited leaves. Each leaf, near the outer margin, is

* It is also called the Great Fan Palm.

divided into numerous segments, and united to the trunk by spiny leaf-stalks. It usually measures about eighteen feet in length, exclusive of the leaf-stalk, and about fourteen feet in breadth; so that a single leaf will form an excellent canopy for a score of men. It is consequently employed for many important purposes—such as roofing houses or making tents. The Singalese noble, on state occasions, is always followed by an attendant bearing above his head a richly ornamented Talipat leaf, which can be folded up, like a fan, into a roll of the thickness of a man's arm, and is wonderfully light. In Malabar, the leaves are used as a substitute for paper, the characters being inscribed with an iron stylus, but they undergo a preliminary process of boiling, drying, damping, rubbing, and pressing. The oil employed in colouring the writing preserves them from insects, but changes with age, so that a Singalese determines the date of a book by carefully smelling at it! *

Above its crown of leaves the Talipat, at the age of thirty or forty years, raises an erect pyramid of flowers, of a bright creamy hue, but disagreeable odour. At first they are enclosed in a hard sheath, from which, when matured, they extrude themselves with a loud noise. To this peculiarity Moore alludes in his well-known lines:—

> "Hearts where, slow but deep, the seeds
> Of vengeance ripen into deeds,
> Till, in some treacherous hour of calm,
> They burst, like Zellan's giant-palm,
> Whose buds fly open with a sound
> That shakes the pigmy forest round!" †

The fruit is abundant, globose, and about an inch and a

* Sir Emerson Tennent, "Natural History of Ceylon."
† Moore, "Lalla Rookh"—The Fire-Worshippers.

half in diameter. As soon as it has ripened the tree decays, and in two or three weeks lies rotten on the ground.

Vegetable ivory, now manufactured into many ornamented articles, is the hardened albumen of the Corosso,* first made known in England by Sir William Hooker. It is clear and liquid at first, then milky and sweet, and finally solid. The stem of the tree which produces the Corosso nuts is so dwarfed that they lie in clusters upon the ground, while its enormous tufts of pinnated leaves attain the height of 20 feet. The Corosso is a native of the sheltered and romantic valleys which nestle among the Peruvian Andes.

Wax is obtained from several species of the Palmaceæ, as from the *Ceroxylon*, or Wax palm, discovered by Humboldt in South America, which grows to a height of 180 feet, and the *Camanba*,† whose fan-like leaves are coated with a yellow wax.

From the *Calamus verus* we obtain the well-known canes called ratans; and the *Sago palm*,‡ which flourishes in the swampy districts of the East, supplies us with a farinaceous food of great value. The *Corypha Australia*, a native of Victoria in Australia, yields a profusion of fan-shaped leaves, which are employed in the manufacture of straw hats. This noble tree attains the stature of 140 feet.

The Palm oil largely used in the manufacture of soap and candles, and in the preparation of the peculiar compound with which the wheels of railway-carriages are greased, is expressed from the nuts of the *Elais palm*, a

* Phytolephas macrocarpa. † Corypha cerifera. ‡ Sagus farinifera.

native of Guinea. The palm-tree worms, the larvæ of a kind of beetle, eaten in Surinam as a delicacy, flourish on the *Areca oleracea*. The *Areca*, or Catechu palm, yields the celebrated Betel nuts, so largely masticated by the Hindus. From these nuts our chemists obtain an astringent decoction, useful in dyspepsia, and many other diseases.

All the palms serve the needs of man. The Date sugar of Brazil is the product of the *Phœnix sylvestris*. The coating over the trunk of *Iriartea Andicola* supplies a substitute for wax. For cordage the inhabitants of Cochin China and Sumatra resort to the fibres of the Cable Cane, or *Calamus Rudentum*. Sago and sugar, and a kind of palm wine, are obtained from *Cayoter urens*.

What would become of the wanderer in the deserts of Arabia and Barbary, if Providence suddenly decreed the extinction of the *Date palm?** Thousands of human beings would inevitably perish, for the inhabitants of Fezzan live wholly upon its saccharine and delicious fruit for nine months of the year. In Egypt, Arabia, and Persia, it forms the principal food of the people, and a man's wealth is computed by the number of date palms he possesses. When dried, the fruit becomes an important commercial staple. Cakes of dates pounded and kneaded, until solid enough to be cut with a hatchet, supply the provision of the African caravans on their toilsome journey through the sun-lighted Sahara. The young leaves, or palm cabbage, are eaten by the Persians and Arabs, who also distil a species of wine from the sap, by fermentation. A single palm will yield three or four quarts daily

* Phœnix dactylifera.

THE DOUM (*Hyphæne Thebaica*), AND DATE PALMS (*Phœnix dactylifera*).

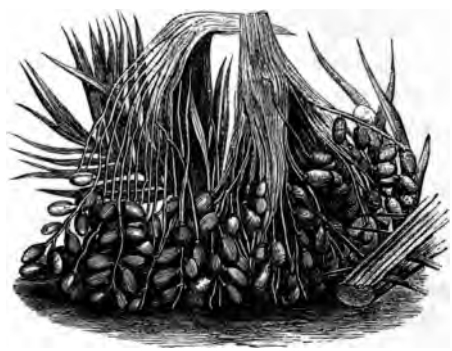
for a fortnight, after which the quantity diminishes, and the tree gradually dries up.* The date stones or seeds are roasted as a substitute for coffee, or ground for the sake of their oil, and the residuum given as food to cattle. Bags and mats are made out of the leaves; the fibres supply a

* General Daumas, "Le Grand Sahara."

rude rough cordage; and the leaf-stalks all kinds of basket and wicker work.

The Date palm is the palm tree alluded to in Scripture, and in the oases of the Great Desert springs up, a fountain of life, for the refreshment of the traveller and the sustenance of the Arab nomade. It generally attains a height of fifty feet, is crowned with a crest of from forty to eighty glaucous pinnated leaves, and flowers at the age of twelve years.*

In Egypt we meet with the *Doum palm*, a tree of shorter stature, but remarkable for the repeated forkings of its stem. From the sweet and yet pungent flavour of its fruit, it has been popularly called the Gingerbread



CLUSTER OF DATES.

Tree; but to an European stomach the gingerbread would prove sadly difficult of digestion. The kernel resembles ivory, and the natives fashion it into beads and other small ornaments.

Both the Date and the Doum palm are found in Egypt,

* Rev. H. B. Tristram, "The Great Sahara."

but the former disappears as the traveller descends the Nile and enters Nubia. Generally speaking, it may be said that the Doum is the Egyptian, as the Date is the Saharan palm tree. Its value is not so great as that of its famous congener, nor are its uses so various; but then the Egyptian is less dependent upon it than the Arab upon the Date. To the inhabitant of the Sahara, the latter is food, comfort, wealth—nay, life. It is easy to understand, says a French writer, the gratitude cherished by the Arab towards this tree, which thrives in the sandy waste, draws sustenance from brackish water fatal to almost every other plant, preserves its freshness when all around it decays and withers under the rays of an implacable sun, and resists the tempests which bow its flexible crest but cannot tear up its solidly-planted roots. It may be said, without exaggeration, that a single tree has peopled the Desert; that, without it, the nomadic tribes of Western Africa must cease to exist.

What the Date palm is to the Arab, the *Cocoa-nut palm* * is to the Polynesian. Originally it would seem to have been a native only of the Indian coasts and South Sea Islands, but it is now diffused over all the tropical world. There are about eighteen known species, of which only one, the cocoa-nut itself, does not belong to America, but flourishes best in the neighbourhood of the sea-coast. It is the crown and glory of the coral islets which stud the sapphire expanse of the Pacific Ocean; its cylindrical and slender stem, about two feet in diameter, and from 60 to 100 feet in height, with its crest of green, drooping, pinnated leaves, generally sixteen to twenty in number,

* Cocus nucifera.

and from twelve to twenty feet in length, forming a conspicuous ornament of the tropical landscape—of

> "The studded archipelago,
> O'er whose blue bosom rise the starry isles;"

and justly entitling it to the poet's praise, as

> "The loftiest Dryad of the woods,
> Within whose infant bosom Bacchus broods." *

The uses of this tree are manifold, and its valuable properties claim man's gratitude. Its hard, agate-like, polished timber, known as Palmyra and Porcupine wood, is prized by the cabinet-maker; the hard nut which encloses its fruit the savage carves into handsome bowls and goblets; the milky liquid within has a sweet and delicious flavour, and is very wholesome, refreshing, and digestible; the fibrous husk can be woven into sails and cordage, or used for stuffing mats and cushions; the terminal bud, or Palm cabbage, is a delicate eating; the central part of the stem, when young, affords a sweet and excellent food; the fermented sap yields the spirituous liquor so well known as arrack; the dried leaves can be employed for thatch; and every boy knows that the nut itself is a popular and justly-prized dainty.†

COCOA-NUT.

Commercially speaking, the most valuable product of

* Lord Byron, "The Island."

† Rev. W. Ellis, "Polynesian Researches;" Rev. J. Williams, "Missionary Enterprise in the South Seas;" Admiral Wilkes, "United States Exploring Expedition," &c.

this all-important tree is the oil or butter obtained from its kernel, and largely used in Europe in the manufacture of stearine candles. In the East it is employed as an unguent, and for illuminating purposes. It is obtained by pressure of the kernel, or by boiling it over a slow fire. Seven or eight nuts will supply one quart. It is liquid in tropical climates, but in colder temperatures solidifies into a white, butter-like oil. Compression separates it into a more liquid part called *olein*, and a more solid part known as *cocosin*, or *cocostearin*.

The Cocoa palm ripens in about seven years, and continues productive for seventy or eighty, each tree bearing annually from eighty to one hundred nuts.

COCOA-NUT TREE (*Cocos nucifera*) AND PLANTAIN (*Musa Paradisiaca*).

The Double cocoa-nut (Cocos de Mer) of the Seychelles Islands, which, in the early days of maritime enterprise, was regarded as a marvel, and originated a score of fables, is the fruit of a palm of a wholly different genus.* It was originally found floating on the waves of the Indian Ocean, and as its birth-place could not at first be discovered, became enveloped in an atmosphere of mystery. As a supposed talisman against poison and infectious diseases, it was eagerly sought after; and a good nut would fetch the enormous sum of £150. It was said that only one tree in the world produced this rare and wondrous fruit—"Solomon's Nut" was the popular appellation—and that its roots were fixed deep in the ocean-bed, while a griffin kept watch and ward over the treasure, as the Dragon over the Hesperidian apples. But in 1768 it was discovered by two French officers, Captain Duchenin and M. Barré, growing plentifully in the Seychelles Islands; and was ascertained to be the fruit of a palm, with a straight slender stem, 100 feet high, which requires upwards of a century and a quarter to reach maturity. The whole tree possesses the useful properties of the family to which it belongs, and flourishes only on two islands in the Seychelles group, which are named Praslin and Curieuse.

What rice is to the Hindu, what wheat is to the European, is the Banana† to the inhabitants of the tropical islands. They would perish without it; or be reduced to feed, like the beasts, on the herbage of the fields. But the banana supplies them with a wholesome and abundant food, with a pleasant drink, with a valuable medicine, with materials for clothing; in a word, with

* Loidoicea Seychellarum. † Order *Musaceæ*.

almost all the necessaries of their simple and easily contented life. It is now understood to be a variety of the plantain; the one bearing the technical name of *Musa sapientum*, the other of *Musa paradisiaca*—both appellations testifying to the esteem in which the plant is held.

For Musa sapientum, "of the wise men," alludes to a statement by Theophrastus that its fruit was the daily fare of the wise men of India; and Musa paradisiaca, to a tradition that it was identical with the Tree of Knowledge of Good and Evil which flourished in the garden-groves of Eden.

> "A goodly tree,
> Laden with fruit of fairest colours mixed,
> Ruddy and gold." *

The name of *Musa* is derived, we are told, from the Arabic word *moz*, a plantain; and the genus comes from the Cape of Good Hope and the islands of the great Eastern Archipelago, where it fattens and flourishes beneath an unclouded sun. Its present range is almost universal, and it will even thrive in regions where the thermometer descends to 45°. It grows most freely in humid localities, and in spots sheltered from the wind; for its large floating leaves, six feet long and two feet broad, of the brightest green, are so delicately woven, that the lightest gust of air will rend them into fragments. These leaves yield a remarkably fine flax, which is manufactured into fleecy muslins. The process is thus:—

The fibres of the petioles † are easily pulled out, and separated with a knife; they are washed in three or four waters, and bleached and dried on linen exposed to the sun; they are then stretched in every direction. After

* Milton, "Paradise Lost."

† The petiole is the stalk of the leaf.

this, they are macerated for an hour in lime-juice, which renders them perfectly white, and fit for spinning; or, if left in a flocky state, they are made into tinder or wadding.

From the stem of the banana a peculiar juice is distilled, which acts as an admirable remedy in cases of diarrhœa.

BANANA (*Musa Sapientum*).

The fruit of the banana, or Musa sapientum, is shorter and rounder than that of the Musa paradisiaca, or plantain. When ripe, it glows like gold externally, and within mellows into a soft creamy hue. Stewed in claret, or fried in butter, it makes a dainty dish to "set before a king." Dried in the sun, or in an oven, and pounded, it can be manufactured into a nourishing kind of bread; as a whitish and fragrant meal, it will keep for a long time, and is not inferior to porridge. In Guiana it is called *Conquin-tay*.

There is more succulence in the plantain than in the banana. It is a native of East India, but must have been

imported into America soon after its discovery by Columbus, since its fruit formed a staple article of food early in the sixteenth century; and now its varieties are scattered over the whole of that great continent.

The stem of the plantain is usually fifteen or twenty feet high. The leaves are very large, frequently ten feet long and three broad; so that one leaf makes a very sufficient shelter from the sun. It is propagated by suckers; and a sucker attains maturity about a year after it is planted. After fruiting, the stem is cut down; but the plantain does not need renewing for nearly twenty years.

Numerous are the uses of this important esculent. We have spoken of its fruit as an article of food: a decoction of it yields a pleasant beverage; the top of the stalk, boiled, is an excellent vegetable; the leaves are employed for packing, and for thatch; and the fibre for textile purposes, and cordage.

Its importance as a staple of nutriment may be inferred from Humboldt's calculation that the food-produce, compared with that of the potato, is as 44 to 1, and with that of wheat, as 133 to 1. A square space of one thousand feet will grow forty or fifty plants; and one acre of ground will yield sufficient support for fifty men. Take a patch of land. Cultivate it with wheat, and it shall nourish its tiller; plant it with bananas, and it shall maintain half a company of soldiers!

Some wild species of the plantain flourish in many parts of the East. One kind, Musa Troglodytarum—common enough in the fair islands of Polynesia—bears its clusters erect and aloft, like a chieftain's plume of feathers, and not pendent, like all other varieties. In the

golden Philippines there lives a species of Musa bearing a green unsavoury fruit, whose stem supplies the well-known Abaca or Manilla hemp

The gorgeous Strelitzias, which are now found in many English hothouses, having been imported from the Cape of Good Hope, belong to the order *Musaceæ*. Their flower-stalks spring, like lances, from the centre of numerous leaves, borne upon long petioles, which are ensheathing at the base. Their flowers are orange and dark blue. The Heliconia, which possesses an edible root, and the Urania,* a plant of more than ordinary beauty, are also members of the Banana tribe. The leaves of the latter have been compared to broad sword-blades; they are eight feet long, a foot wide, and rise straight upwards, alternately, from the top of a stem five or six feet high.

The poet Southey, in a well-known passage,† describes the "Banyan, or Indian Fig," with as much felicity as truth. The quotation is somewhat hackneyed, yet may be new to our younger readers. The scene is "a green and sunny glade" in a tropical forest,—

"And in the midst an aged banyan grew.
It was a goodly sight to see
That venerable tree;
For o'er the lawn, irregularly spread,
Fifty straight columns propped its lofty head;
And many a long depending shoot,
Seeking to strike its root,
Straight, like a plummet, grew towards the ground.
Some on the lower boughs, which crossed their way,
Fixing their bearded fibres, round and round,
With many a ring and wild contortion wound;
Some to the passing wind, at times with sway
Of gentle motion swung;
Others of younger growth, unmoved, were hung
Like stone-drops from the cavern's fretted height.
Beneath was smooth and fair to sight,

* Urania Amazonica, or Wild Banana. † Southey, "Curse of Kehama."

Nor weeds nor briars deformed the natural floor;
And through the leafy cope which bowered it o'er
Came gleams of checkered light.
So like a temple did it seem, that there
A pious heart's first impulse would be prayer!"

The Banyan, or Pagod tree,* is a native of sunny Hindustan and Cochin-China, and frequently attains an almost incredible size. I have read of one which had no

THE BANYAN TREE (*Ficus Indica*).

fewer than 350 stems, each stem equal in girth to a large oak, besides 3000 smaller ones; the whole forming a canopy of foliage overspreading an area of 1700 square

* Ficus Indica; order *Urticaceæ*.

yards, and covering a space capable of containing 7000 persons. That is to say, this one tree extended over as much ground as the transept of the Crystal Palace, or St. Paul's Cathedral. Its leaves are shaped like a heart, about five or six inches long; and its fruit resembles, in shape, size, and colour, a rich scarlet cherry, growing in pairs from the axils of the leaves. The branches frequently extend over two acres horizontally, straight out from the trunk, and send forth long straight shoots or arms, which root themselves in the ground, and form props—like smooth pillars, covered with silvery bark—for the boughs, and simultaneously supply them with additional moisture from the earth. The main trunk will measure about 28 feet in girth, and 60 to 80 in height. The props or stems frequently possess a circumference of 10 to 14 feet. In the branches the Bonzes, or Hindu hermits, plant their huts; and in their pleasant shadow the traveller protects himself from the ardour of a tropic sun.*

In Moore's "Lalla Rookh," the procession of the princess is represented as encamping under a banyan—under one of those holy trees, says the poet, whose smooth columns and spreading roofs seem to destine them for natural temples of religion. The Hindus convert them into temples, placing their idols under its shade; wherefore they call it the pagod tree. In some places, says Pennant, it is believed to be the haunt of spectres, as the ancient spreading oaks of Wales have been of fairies; in others are erected, beneath the shade, pillars of stone, or posts, elegantly carved, and ornamented with

* So Milton:—

"The bended twigs take root, and daughters grow
About the mother-tree, a pillared shade."—*Paradise Lost.*

the most beautiful porcelain, to supply the place of mirrors.

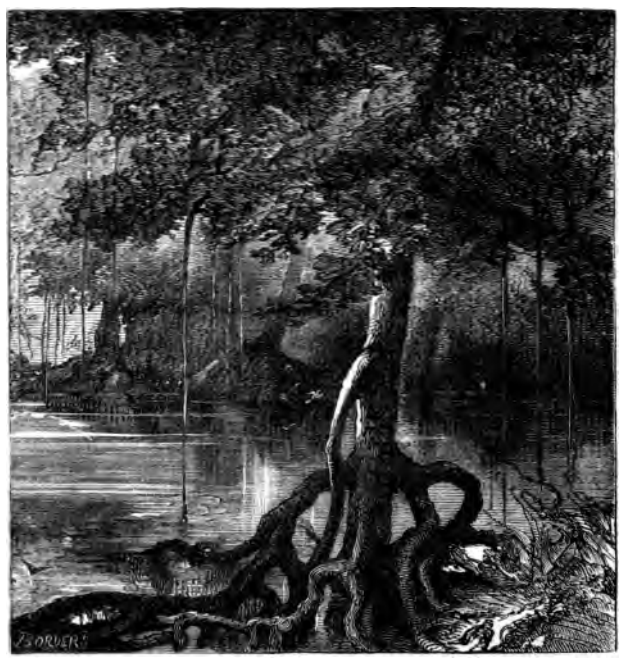
As for the fruit, only birds and monkeys eat it; but its milky juice supplies a kind of caoutchouc, and the wood of the larger stems is useful from its toughness and lightness.

Allied to the banyan is the *Pippul tree*,* a native of Ceylon and the Indian mainland, where it receives a considerable amount of veneration—Vishnu being supposed to have sprung into life under the pippul, and Buddha to have enjoyed its shade. The leaves are heart-shaped; eight inches long, and six broad, at the broadest part. Unlike the banyan, its branches do not send forth any roots; but it yields a caoutchouc juice. Most of the Indian caoutchouc, however, is obtained from the various species of Ficus, or fig tree—such as the *Ficus elastica* and *Ficus toxicaria*.

All the individuals of the Mangrove genus † are tropical, and all natives of the coast, especially of estuaries and the mouths of great rivers, where they flourish in the mud—extending their closely intertwined roots even down to low-water mark, and often presenting to the voyager an impassable barrier. Most of the species possess the peculiar property of sending down roots from their branches; and thus they spread with great rapidity over an immense area, forming thick mangrove forests, the resort of myriads of aquatic birds, of innumerable legions of crabs, and of hosts of shell-fish, which adhere to their branches. The leaves are of a dark glossy green, which contrasts pleasantly with the long narrow scarlet pods. The wood is hard and

* Ficus religiosa; order *Urticaceæ*. † Order *Rhizophoraceæ*.

durable. From the roots, when left bare by the receding tide, a sickly odour arises; and the vicinity of a mangrove forest is always cursed by the deadly malaria. It is partly



A MANGROVE FOREST.

to this circumstance must be attributed the unhealthy character of the estuaries of the African rivers.

The seeds germinate while still attached to the parent branch. The pod opens at the bottom; the young plant, with its long thick radicle, extends itself, and rapidly

grows downwards; until the fruit falls off, penetrates into the mud, and in due time rises into a lofty tree.

The whole number of species known is about twenty. The fruit of the common mangrove (*Rhizophora mangle*) is sweet and eatable; and its fermented juice yields a light wine.

Mr. Kingsley has painted a mangrove forest with his usual pictorial power:—

"The shore," he says,* "sank suddenly into a low line of mangrove wood, backed by primeval forest. The loathy floor of liquid mud lay bare beneath. Upon the endless web of interarching roots great purple crabs were crawling up and down. The black bank of dingy leathern leaves above; the endless labyrinth of stones and withes (for every bough had lowered its own living cord, to take fresh hold of the foul soil below); the web of roots, which stretched far away inland;—all seemed one horrid complicated trap for the voyager; there was no opening, no relief—nothing but the dark ring of mangroves, and here and there an isolated group of large and small, parents and children, bending and spreading, as if in hideous haste to choke out air and sky. Wailing sadly, sad-coloured mangrove-hens ran off across the mud into the dreary dark. The hoarse night-raven, hid among the roots, startled the voyagers with a sudden shout, and then all was again silent as a grave. The loathly alligators, lounging in the slime, lifted their horny eyelids lazily, and leered upon you as you passed with stupid savageness. Lines of tall herons stood dimly in the growing gloom, like white fantastic ghosts. All was foul, sullen, weird as witches' dream."

* Rev. C. Kingsley, "Westward Ho!"

Happily, no landscape so dark and drear as this pollutes our British shores, and threatens the mariner with delirious death!

To the natural order or family which botanists distinguish as Coniferæ, Conifers, or Cone-bearing trees, and to the genus Abies, or, according to other authorities, to the genus Cedrus, belongs the stately *Cedar*.

There are many varieties of this noble tree. In the south of Europe, and especially on the warm slopes of the Pyrenees, flourishes the Spanish cedar. In the sunny air of the West Indian Islands—those fair Antilles so lavishly endowed by Nature—bloom the rich flowery panicles of the Barbadoes cedar, which rears its solid trunk to the height of seventy or eighty feet. Its wood is remarkably fragrant, but not so its fruit, its bark, or its leaves; these all exhale a disagreeable odour. Nor is it a true cedar, only resembling the cedrus in the resinous properties of its timber. The red cedar, which clothes with dense shadowy groves the heights of California, is a species of fir. But a true cedar is the magnificent Deodar,* the Devadara or god-tree, which the Hindus regard with peculiar veneration; and which, at an elevation of from 7000 to 12,000 feet, spreads about the craggy sides of the Himalayas in deep, dark, mysterious forests. It frequently rears its pillar-like trunk some 150 feet above the ground, and rejoices in a mass of far-spreading branches which might shelter a battalion of soldiers. Then there is the cedar of Algiers,† which flourishes on the lower ridges and spurs of the Atlas Mountains. Both these species, according to Dr. Hooker,‡ are identical with the

* Cedrus Deodara. † Cedrus Atlantica. ‡ Dr. Hooker, "Himalayan Journals."

cedar of Lebanon. The deodar is well known in our British gardens, but rather as an ornamental shrub than as a tree. At least, the writer has never seen any considerable specimens of it. Its wood is durable, close-grained, hard, and yet so resinous that its splinters burn like candles. Its turpentine is used medicinally in Hindustan; its tar and pitch for various purposes; and its wood, when polished, for articles of furniture.

But the classical species of Cedrus is the far-famed cedar of Lebanon,* so called from its native home in the mountainous regions of Palestine. It has enjoyed a distinguished reputation from the remotest antiquity. The ancients highly valued its timber on account of its durability; for, such is the pungency of its bark, no insect will venture to touch it. Its Hebrew name *erez*—compact or compressed—refers to the excessive firmness of its roots. In Holy Writ we meet with numerous references to its admirable characteristics.

Thus the prophet Ezekiel describes it (xxxi. 3, 5) as: "A cedar with fair branches, and with a shadowing shroud, and of a high stature. . . . . his height was exalted above all the trees of the field, and his boughs were multiplied, and his branches became long because of the multitude of waters, when he shot forth."

The fragrancy of its wood caused it to be employed for purification: "And the priest shall take cedar wood, and hyssop, and scarlet, and cast it into the midst of the burning of the heifer" (Num. xix. 6).

It was with cedar wood that Solomon adorned the interior of the great Temple, and he sent to Hiram, King of

* Cedrus Libani.

Tyre, for "cedar trees out of Lebanon." And Hiram replied to the Jewish sovereign's demand: "I will do all thy desire concerning timber of cedar, and concerning timber of fir. My servants shall bring them down from Lebanon unto the sea: and I will convey them by sea in

CEDARS OF LEBANON (*Cedrus Libani*).

floats unto the place that thou shalt appoint me, and will cause them to be discharged there, and thou shalt receive them" (1 Kings v. 8, 9). So the glorious House of the Lord was covered with beams and boards of cedar, and within, the walls were built with boards of cedar, and the floor, and the walls of the ceiling; there was no stone

seen—all was cedar—and cedar finely carved with gourds and festoons of flowers.

Cedar was also employed by David for the palace which he built at Jerusalem (1 Chron. xiv. 1); and by Jeshua and Zerubbabel in the second temple which was erected in the Holy City after the captivity.

It was on the loftier heights of Lebanon that the cedar flourished—flourished in immense green forests, whose shadow stood out dark and deep against the radiant Eastern sky. Alas, how are the mighty fallen! The woodlands which spread over leagues and leagues, which not even the axes of Hiram's 30,000 workers could destroy, though they laboured for many months, are now reduced to one scanty grove, which, according to Dr. Hooker, contains but four hundred trees. And of these four hundred, not above twelve of the ancient race remain. The others are offshoots, of comparatively modern date. But some of the patriarchs are venerable with an old age far exceeding the old age of the European forests. Several are estimated at from four hundred to eight hundred years old; the age of the twelve elders is beyond computation. Of the younger trees, the youngest will number two hundred years.

This cedar grove, sole relic of the Lebanon glories, is situated high up on the western slope of the mountain-range, ten hours south-east from Tripoli, and at an elevation above the sea-level of 6172 feet. The space which it covers does not exceed half-a-dozen acres, or about three-quarters of a mile in circuit; and nowhere else is the scenery so ruggedly grand or so Alpine, nowhere else are the proportions so gigantic, or the ravines so profound and awful.*

* Dean Stanley, "Sinai and Palestine."

"The wood, bark, cones, and even leaves of the Lebanon cedar are saturated," says Dr. Thomson,* "with resin. The heart has the red cedar colour, but the exterior is whitish. The branches are thrown out horizontally from the parent trunk, with a slight upward inclination, which the Arabs consider a sign of its superior intelligence. This inclination, they assert, is always greater before a fall of snow, as if the tree anticipated, and prepared to receive, its burthen. Climb into a cedar tree, and you meet with a succession of verdurous floors or terraces circling around the trunk, and gradually decreasing in dimensions as you ascend. The beautiful cones seem the natural ornaments of this delightful green flooring."

Most of the Lebanon patriarchs are about fifty feet in height, and their girth is represented by the same figure. One, however, measures sixty-three feet in circumference. They spread out their branches to an enormous distance, so that beneath their umbrageous canopy a darkness like that of twilight prevails even at noonday.

The Arabs call them "the saints." They worship them with a deep reverence, and believe that a severe retribution will assuredly overtake the rash or presumptuous individual who may venture to lay rude hands upon them. Once a year, at the Feast of the Transfiguration, the Greeks, Maronites, and Armenians wind up the mountain-side in long procession, and celebrate mass on a plain stone altar erected in their shade.

The cedar is known by its horizontal branches, which divide irregularly into branchlets; by its dark green pointed leaves; its erect oval cones, about four inches long,

* Dr. Thomson, "The Land and the Book."

and three in diameter; and its reddish fragrant wood. It loves a dry open soil, yet requires that its roots should find their way to an abundance of water. It was introduced into England towards the close of the seventeenth century, and has become permanently naturalized. It is even found in a flourishing condition as far north as Inverness. At Norbury Park, near Leatherhead, in Surrey, the cedars have attained a noble growth, and form—

> "A pillared shade,
> Upon whose grassless floor of red-brown hue,
> . . . ghostly shapes
> May meet at noontide—Fear and trembling Hope,
> Silence and Foresight—Death the skeleton,
> And Time the shadow."*

Those of Deepdene, near Dorking, are not less magnificent —"ranging in colour from the black green of the yew to the silvery gray of the deodara." Whoever has floated down "the regal Thames" between Weybridge and Walton, must remember the noble old trees which adorn its grassy bank near the ancient site of Ham House. They are among the principal ornaments of the luxuriant landscapes which lie about Sheen and Richmond. At Lord Middleton's seat of Peperharow, four giants flourish, which were planted in 1736. One of them measures fifteen feet in circumference at three feet from the ground. Some of its branches span seven feet, and its dark verdant terraces of leaf extend for nearly 100 feet horizontally.† Not less worthy of note are those at Goodwood, in Sussex. One thousand were planted by the third Duke of Richmond in 1761. Only 158 now remain, but these are of unusual size. The largest boasts of twenty-five feet girth.

* Wordsworth. † Brayley, "History of Surrey."

I have said that the wood of the cedar defies the attacks of insects. Its durability may not be doubted, for it was found in the temple of Apollo, at Utica, undecayed, after a lapse of two thousand years. Its pitch was formerly used in embalming; and Gerard, the old botanist, declares it was good for the eyes, and, when mixed with vinegar, cured "worms in the ears and the bites of serpents."

The finest cedar in France is that which Daubenton, the naturalist, planted in the Jardin des Plantes of Paris. It may be termed an historical tree. A chance shot, during the celebrated siege of the Bastile, struck off its terminal branch, and consequently arrested its upward growth. As some compensation, however, it spread out its great green branches horizontally with renewed vigour, and still flourishes—a stately and honoured patriarch.

For the following observations I am mainly indebted to a contemporary author.* They will serve to impress on the reader's mind the distinctive features of this "tree of the Lord."†

In the first place, remark that the cedar is a member of the great Coniferous family. Now the cone is one of the oldest and best known mathematical figures, to which the Ninivehites and Babylonians of old attached a mystical significance. You will find it prominently displayed among the sacred symbols sculptured on their monuments. And as in human, so in vegetable history, it is one of the oldest figures. In every part of its organization the cedar is moulded according to this plan, and from the seed to

* Rev. H. Macmillan, "Bible Teachings in Nature."

† "The trees of the Lord are full of sap; the cedars which He hath planted."—Ps. civ. 16.

the perfect plant exhibits a continued development of the same cone-like pattern.

A wonderful unity pervades all parts of the cedar. The cotyledons, or first-springing leaves, which vary from six to fifteen, are arranged in a conical form; the seed vessels are called cones on account of their shape; the very clusters or branches of the stamens assume the same configuration. Each part represents the other; and from the commencement in the seed to the termination in the cone, we have in each organ a miniature of the whole tree. We may say of the cedar cone, as Dr. M'Cosh says of the pine cone, with which it is identical, that it will reward the study for hours together of the highest intellect. It is a wonderful instance of design, forethought, and contrivance; a practical refutation of the fanciful theories of the naturalist.

The cedar, and trees of the same class, inhabited the earth, and formed its forests, in the remote antiquity of the carboniferous period. They are the elements and basis of the coal which warms our apartments, and sets in motion our mighty machines. Examine a piece of coal with a magnifying glass, and you may often trace in it the outline of leaf, and branch, and trunk—long ago overthrown by the swirl and rush of the floods—buried deep beneath the contorted and upheaved strata, and by the agency of heat and pressure reduced into a solid and compact mass! What a marvellous vista, says Mr. Macmillan, is opened up to us by this fact, between the human period and a geological past so remote that it seems almost mythical. Innumerable ages before man had been placed in Eden to dress and keep its radiant garden-bowers, the

cedars were purifying the atmosphere, absorbing carbonic acid gas and throwing off oxygen, and while they thus prepared the earth for its future tenant, they were also storing up, by the same marvellous process, in the vast quantities of carbon which they thus appropriated, a mechanical energy, destined, after a sleep of millions of years, to rise again as the great physical regenerator of the human race.

There are three grand monarchs of the mountains: the *Cedrus Deodara*, of the Himalaya; the *Cedrus Atlantica*, of the Atlas range, in North Africa; and the *Cedrus Libani*, of the Lebanon; and each resembles the other so nearly that all may be considered varieties of the same species. It is worth notice that they are all found in similar situations, being restricted absolutely to the *moraines* of extinct glaciers. The Indian cedar is connected with the sublimest glacial phenomenon to be found in the whole world. It not only flourishes on the mounds produced by glaciers, but near the spots where it grows, large fossils of antelopes, rhinoceroses, and other tropical fauna are found, thus proving that, within a very recent period, the great Himalaya range has been elevated some eight or ten thousand feet. Of these mighty changes the cedar was, in all probability, a silent witness; and, erect amid the ruin of volcano and glacier, surrounded by the sublimest earthly objects, they may well excite the reverence of every thoughtful mind.

Archbishop Trench, in his learned and thoughtful book on the "Parables," has some very judicious observations on the love of nature. "The lover of a truth," he says, "which shall be loftier than himself, will not be moved from his

faith that however man may be the measure of all things here, yet God is the measure of man—that the same Lord who sits upon His throne in heaven does with the skirts of His train fill His temple upon earth—that these characters of nature which everywhere meet his eye, are not a common but a sacred writing—that they are hieroglyphics of God; and he counts this his blessedness that he finds himself in the midst of such, and because in the midst of them, therefore never without admonishment and teaching. This entire moral and visible world," he continues, "from first to last, with its kings and its subjects, its parents and its children, its sun and its moon, its sowing and its harvest, its light and its darkness, its sleeping and its waking, its birth and its death, is, from beginning to end, a mighty parable, a help at once to our faith and our understanding."

In the vegetable kingdom there are parables enow of which poets and divines and philosophers have often made excellent use. These "characters of nature," these "hieroglyphics of God," have received all the illustration that the loving faith and gentle wisdom of the purest spirits could give them. Not a tree, not a plant, not a flower, from the stately oak to the modest violet, from the graceful palm to the shrinking mimosa, but has afforded a theme for thought, a suggestive fountain of fancy and imagination. There flourishes a tree on the luxuriant bank of many a West African river which might easily be made to point a moral and adorn a tale. Its size is immense; seen from afar, its huge trunk looms against the hot sky like a rock; the most massive buttress with which human hands ever sought to strengthen a palatial building is but as a reed when compared with it. You would think

that its timber was the solidest, the hardest, the most impenetrable of any tree in the world. Yet in truth, its wood is singularly soft and fibrous; there is no grain, no hardness in it; you may scoop it as you would the pith of a cane. Now, do you want an illustration? Take one from history, and compare it to some mighty empire, which to all appearance is a colossal giant—imperishable and unconquerable—and yet, examined more closely, proves to be without any genuine solidity, and is neither enduring nor compact. Thus there are "tongues in trees;" and every forest, every grove, is full of eloquent voices, which speak to all who have ears to hear the lessons of love and wisdom.

Do you know upon what tree I have based this little sermon of mine, dear reader? Probably not; the Baobab, wondrous as it is, enjoys no such world-wide reputation as the cocoa-nut or the bread-fruit tree. One reason for its limited fame is the comparatively recent date of its introduction into Europe.

There was born at Aix, in Provence, on the 7th of April 1727, one Michel Adanson; born of French parents, but descended from a Scottish stock. He was educated at Paris. At an early age he manifested a warm love of natural history studies, and was never weary of investigating the properties of plants or the habits of animals. With such tastes it was fortunate for him that his masters were Reaumur, the inventor of the well-known thermometer, and Bernard de Jussieu, the eminent naturalist. When only twenty-one years old, he embarked for Senegal, considering that there a vast and unoccupied field lay before him in the study of the productions of that part of

Africa. He spent five years in the colony, and gathered together very valuable and extensive collections of plants and animals. Then he returned to France, and about 1757 published an account of his labours and adventures, entitled, "Histoire Naturelle du Senegal."* In this work was embodied a description of the remarkable tree to which I have referred, and which the Africans know by the name of the Baobab.

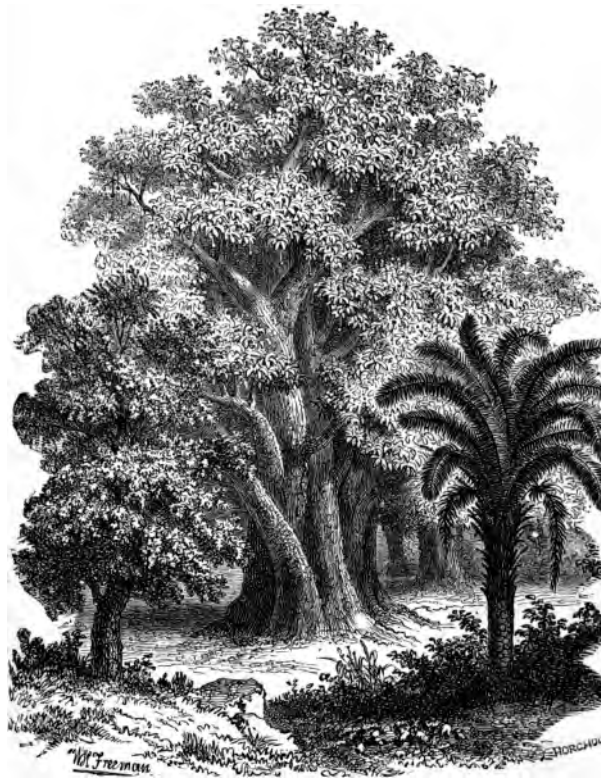
Before I proceed to say a few words about its marvels, I may state that Adanson spent a long and virtuous life in the pursuit of his favourite studies; that he suffered great privations during the stormy time of the French Revolution; and that he died on the 6th of August 1806, in the eightieth year of his age.

As a monument to his memory, botanists have named the Baobab, in their scientific nomenclature, *Adansonia digitata*. The genus to which it belongs, and of which it forms the only known species, is included in the natural order *Sterculiaceæ*, and distinguished by a simple deciduous calyx (or cup), a very long style, with numerous stigmas, and a wooden capsule (or shell-like covering) containing a farinaceous pulp. To this same order belong the Silk-Cotton trees, such as the Bombyx and the Eriodendron, and the Theobroma Cacao, which yields the well-known and nutritious *cocoa*. Mucilage, therefore, seems the predominating property of all the trees of this great family.

The Baobab is the *largest* known tree in the world. Not that it is the *loftiest*, for in height it is surpassed by many, but that its trunk is the most massive, often attaining a

* "Biographie Universelle," art. *Adanson*.

diameter of from 20 to 30 feet, and a circumference of from 90 to 100. Its branches are like ordinary forest trees in thickness, and frequently 70 feet in length, while they



THE BAOBAB TREE (*Adansonia digitata*).

form a hemispherical head of 120 to 150 feet in diameter, like a monster-dome or canopy of foliage. The leaves are

digitate—that is, divided like fingers; the flowers white and exceedingly large, on drooping stems or peduncles of a yard long.

The trunk of the Baobab is rugged, and rent into wide furrows, which afford securely-sheltered nooks for sheep and other animals. The branches, as may be supposed, spread over a vast area of ground, and their fruit are suspended from the under side, clothed with a very rich, deep-sea green, downy substance, which induced Captain Clapperton to compare them to "so many velvet purses." The popular English name for them is "Monkey-Bread;" because they are much relished by the monkeys, who conceal themselves among the interlacing boughs, and find a pleasant asylum in the overlapping foliage.

The rind of the Monkey-Bread is not hard. Within, the dark seeds are affixed to numerous fibres, and the whole is embedded in a farinaceous, cream-coloured, sub-acid pulp, which the Africans consume as food, and employ to thicken their soups.

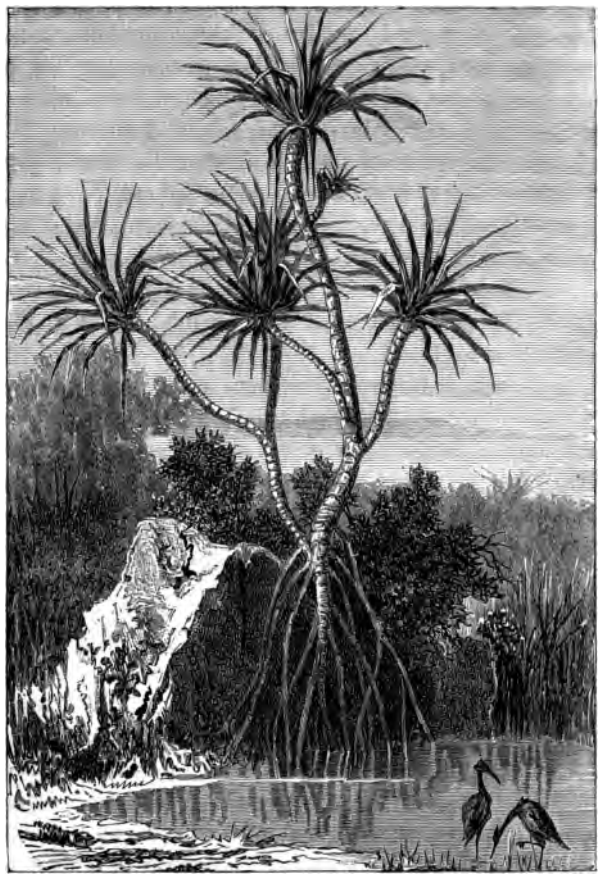
The medicinal properties of the tree are important. The dried pulp, mixed with water in certain proportions, is useful in cases of dysentery. The leaves, when dried and powdered, are called *Lalo* by the negroes, who use them in this state as a remedy for diarrhœa, fevers, and other diseases, and to check excessive perspiration. The expressed juice of the fruit, mixed with sugar, is considered a specific in putrid and pestilential fevers—for every poison, you see, God mercifully provides an antidote!—or, taken with water, it forms a most refreshing beverage.

I have already pointed out that the timber of this colossal tree is not what might have been expected from

its huge dimensions; it is soft, fibrous, yielding, and almost wholly destitute of carbon. The Baobab loses its leaves annually, just before the heavy rains set in; and then its mighty trunk, and scarcely less mighty branches, all bare, and desolate, and sombre, present a very impressive spectacle. It stands like an aged monarch, shorn of all regal splendour; like some patriarchal chief, who has stripped himself of his pomp in a time of sorrow and lamentation.

There can be no question that the Baobab attains to a remarkable longevity. Some botanists have gone so far as to assert that there are individuals now existing which witnessed the roaring floods of the great Deluge! Adanson met with a tree, about 32 feet in diameter, whose age, from the concentric layers of its trunk, he estimated at 5500 years. Undoubtedly, there is a considerable amount of exaggeration in this statement; but, at all events, among the wonderful "characters of Nature," and among the stranger features of the Vegetable World, I think we may justly rank the colossal Baobab.

It is impossible to exaggerate the beauty of the Madagascar forests. Their tropical luxuriance astonishes the European, accustomed to the sober stateliness of the woods of Norway, the piny wildernesses of the Apennines, or the beech groves of our English hills. Gigantic ferns mingle with rare feathery grasses, and over all rise the elegant columnar trunks of crested palms, while the exquisite Lattice-Leaf Plant spreads its delicate reticulated folioles over the dimpling surface of the sequestered streams. The flora of Madagascar is remarkable for its novelties. This *Lattice-Leaf Plant*—Water Yam, Lace-Leaf, or Ouviran-



THE VACQUOIS, OR VACOA (*Pandanus utilis*).

drano, as it is variously called—has no fellow or congener in any other clime. Its root-stock, about nine inches long,

and as thick as a man's thumb, wears a light brown skin, with a white central farinaceous pith, which renders it no unsavoury food. The flower-stalks, peeping just above the water of the running brooks in which the plant delights, terminate in bright forked spikes of flowers; but the most curious feature is the leaf, which lies just under the surface of the water, is of an elongated oval form, and woven—literally woven—of fine tendrils, crossed at right angles, so as to resemble the most exquisite network. You cannot conceive of anything more perfect in design or execution. It would put to shame the productions of the most celebrated looms.

The *Vacquois* or *Vacoa* (Pandanus utilis) is also worthy of notice. Its leaves are singularly tenacious, and are used by the Malagasy in the manufacture of sacks or bags for the transport of valuable goods. Large quantities are exported annually.

The *Cerbera Tanghin* (or Tanghinia venenifera)* bears a seed of peculiarly poisonous properties. It is no larger than an almond, and yet it is said that one would be sufficient to poison twenty persons. Its active principle is called tanghicin, and, like strychnine, it produces the most violent convulsions, followed by asphyxia. The Malagasy use it in their trials of ordeal. Just as in the Dark Ages the accused were made to walk over red-hot ploughshares, or flung into ponds, and their guilt or innocence determined by the result of the cruel experiment; so the Tanghin seed is administered in Madagascar to the unfortunate criminal. If, by vomiting, he reject it from his stomach, he is declared innocent; if death ensue, he is

* Order *Apocynaceæ*, or Nux Vomica tribe.

pronounced guilty. And yet it is evident that his chances of escape will depend solely on his strength of constitution, or on the connivance of his judges, who might find the means of administering a powerful emetic.

THE TANGHIN TREE (*Tanghinia venenifera*).

The island-forests also supply numerous gum-yielding essences; among others, the Copal-tree, which furnishes the gum resin employed in the arts under the name of copal; and the Vahea, whence a much-esteemed kind of caoutchouc is extracted. Numerous lianas, and a multitude of epiphytous plants, twine round the trunks of the forest-trees, and interlace among each other in apparently inextricable confusion. We can only refer to the *Abrus peccatorius*, whose red and black seeds, commonly known as Angola pease, are woven in pretty necklaces; the *Angrœcum sesquipedale*, an orchidaceous plant with large irregular flowers; the *Angrœcum fragrans*, whose odorous leaves furnish a pleasant and wholesome infusion; and the gorgeous *Heritiera argentea*, whose

THE TRAVELLER'S TREE (*Urania speciosa*).

tall trunk is adorned with a profusion of silver-white leaves.

But the most notable of the vegetable wonders of Mada-

gascar is the Traveller's Tree.* Its stem resembles that of the plantain, with which it is otherwise allied; but it sends out its leaves like wings, or like a large expanded fan, only on two opposite sides. As the lower leaves gradually decay, in an aged tree the undermost clusters will be twenty to forty feet above the ground. There will generally be found a score of these leaves on a vigorous trunk, the stalk being six to eight feet, and the bright, emerald-green oblong blade four to six feet in length. The fruit grows in three or four bunches; forty or fifty fruit in each bunch; and each fruit containing a quantity of the silkiest fibre imaginable, of a beautiful purple tint, and enclosing thirty or thirty-five seeds. The leaves are much used for the thatch, and the leaf-stalks, twisted together, for the walls of the islanders' huts. But the property which has procured for the Urania its distinctive appellation of the Traveller's Tree, resembles the beneficent arrangement of the pitcher-plants: its petioles always contain water, even in the hottest and driest period of the year; and the wayfarer, if he feels athirst, has only to pierce the thick part of the base of a leaf-stalk, to obtain fully a quart of pure and refreshing liquid.†

The *Cactæ* or *Cactaceæ* form a very numerous family, including nearly five hundred known species, while the real number is undoubtedly greater. They are all, however, natives of America, and most of them of the intertropical regions of the New World. Here they flourish in extraordinary vigour, and with their strange fantastic forms lend a peculiar and most original character to the

* Urania speciosa, or Ravenala Madagascariensis: Order *Musaceæ*.
† Rev. W. Ellis, "Three Visits to Madagascar."

landscape. They are among the plants which the poet describes as adorning the scenery of that romantic isle where first the vision of Columbus was fulfilled:—

> "Here, blue savannas fade into the sky;
> There, forests frown in midnight majesty;
> Ceiba and *Indian fig*, and plane sublime,
> Nature's first born, and reverenced by Time!" *

They are all distinguished by the same generic qualities; the stems are fleshy, either simple or branched, and often

A GROUP OF CACTACEÆ.

very soft and succulent. Many, when advanced in years, have a sort of woody centre, composed of rings which increase yearly, and covered with a layer of inner bark, so that the fleshy, juicy portion is in itself only a layer of bark. Instead of leaves, they usually present strange clusters of hairs or prickles. One species alone, the *Per-*

* Rogers, "Vision of Columbus."

eskiæ, wear those folial decorations which to an English eye seem an essential part of shrub or plant; but in wondering at their remarkable conformation and the exceeding beauty of their flowers, the lack of leafiness is soon forgotten.

It is impossible to describe the weird grotesqueness of shape which they often exhibit. One might be pardoned for supposing them to be freaks of Nature. If seen only on the canvas of the artist, we should undoubtedly refer them to the ingenious exercise of his imagination. The *Torch thistle* may be compared to a spear throwing off many minor javelins; the stem of the *Pereskiæ* to a thorny imitation of a palm tree, for it bears a thick crown of branches on a straight column, thirty feet in height; the *Mesembryanthemum inflexum* covers the ground with an infinity of bright terminal flowers; the *Euphorbia grandidens* reminds you of a stately candelabrum; the *Opuntia*, or Indian fig, divides its stem into prickly leaf-like sepals; while the *Melocactus*, or Melon thistle, swells out into a finely-marked globular gourd, adorned with branching flowers. There are some with flat, some with angular, others with channelled stems; many creep and climb up taller trees; not a few drag their slow length along the ground. They are all hardy, vigorous, capable of enduring prolonged thirst; their epidermis, or outer skin, being of so tough a nature that it is neither affected by a dry atmosphere nor a burning sun. And though there are several species which ascend the Andean slopes even to the very border of the clime of eternal snow, most members of the family love to plant themselves on a dry rocky soil, and there, under a sky which is almost always

hot and fierce, they spread and thrive, until they cover leagues of barren plain with their wonder and their beauty; for not even the desert places of the earth will God leave without abundant evidence of the wondrous wealth and depth of His creative power.

One of the commonest species is the *Cactus opuntia*, which, rapidly forming an almost impenetrable fence, is much valued by American settlers as a protection for their enclosures. One of the most useful is the *Melocactus mammillaris*, which abounds on the waterless plains of North America, and is there esteemed by the traveller with as sacred a love as the well in the Sahara by the Arab caravan. Its stem affords from half to a full pint of clear limpid water. Judge, therefore, of the delight with which the parched, gasping, thirsting wayfarer, scorched by an unclouded sun, and spent with fatigue, alights upon a group of these vegetable fountains, these natural reservoirs of life! One of the most beautiful is the *Night-blowing Cereus*,* well known in our English conservatories, and whose bright flowers expand only at midnight, closing them at dawn, never to open again; reminding us of a poet who gives one precious song to the world, and is silent for ever after.

"Children of night! unfolding meekly, slowly,
To the sweet breathings of the shadowy hours,
When dark-blue heavens look softest and most holy,
And glow-worm light is in the forest-bowers;
To solemn things and deep,
To spirit-haunted sleep,
To thoughts, all purified
From earth, ye seem allied;
O dedicated flowers!"

The *Euphorbium* tribe are sometimes distinguished as a

* Cereus speciosissimus.

separate order, but there can be no question that they are closely allied to the Cactaceæ, both in properties and form. There are not less than twenty-five hundred species, and a majority of these flourish in tropical America. The principal feature in their physiology is the acrid milky juice which they contain, as in the *Caoutchouc:* thus the milk of the *Euphorbium thymifolia* is considered a good vermifuge by the Tamúl medicine-men; with that of the *E. hectagona* the Indians poison their arrows; that of the *E. balsamiferum* furnishes the Canary Islanders with an agreeable jelly; while that of the *Manchineal* or *Hippomane mancinella* yields a deadly venom. It is said that if you take shelter under its boughs during a shower of rain, the droppings from the leaves will produce ulcers and blistering wounds upon your skin. But close beside it always grows the *Trumpet flower*,* whose sap is an excellent antidote to the Manchineal poison. Evil never stands alone in this world; good invariably

FRUIT OF THE MANCHINEAL.

* Bignonia leucoxylon.

thrives and blooms in its vicinity, as if to bid us remember that the love of God is infinitely more enduring than His wrath.

Resembling the Cacti in singularity of form, though belonging to a distinct order,* is the *Stapelia hirsuta*. It grows near the ground, with strange prickly stems, and brilliantly coloured flowers, attracting the traveller by its quaint shapes and bright hues, but quickly repelling him by its nauseous odour of carrion. Swarms of flies hover around it, or cluster on its petals, just as they might upon some putrid carcass. The different species of Stapeliæ are popularly distinguished by the name of *Carrion flowers*.

In Texas the traveller meets with several species of the Yucca, of which the handsomest is certainly the *Yucca Treculeana*,† so named after its discoverer, M. Trécul. From its rich tuft of leaves springs a marvellous cluster of white bell-shaped flowers, covering the rocky plains where it grows with beauty. It is frequently found associated with one of the Cacti, the *Opuntia frutescens*, and with the thistle-like *Silphium terebenthinaceum*, whose tall stalk wears at its summit one perfect flower. Another fine Cactus, found in Western Texas, is the *Opuntia microdasys*, a robust thorny plant of fantastic appearance, not uncommon now in English conservatories; and the landscapes are also enriched with the quaint *Cereus Peruvianus;* the globular *Mamillaria rodanthe*, with its rosy blossoms; and the rare *Echinocactus robustus*, not less curious than rare.

From the plants of myth and song I return to those of commerce. Caoutchouc is not a poetical article, and

* Order *Asclepiadeæ*. † Order *Liliaceæ*.

though its uses are manifold and important, we do not suppose that the liveliest imagination could fashion a legend out of them. Its introduction into the arts, sciences, and manufactures—for it figures in each—was comparatively recent. It was first imported into Europe about 1730; and, forty years later, Dr. Priestley astonished the scientific world by informing them that "he had seen a substance excellently adapted to the purpose of wiping from paper the marks of a black-lead pencil." It was then sold at the rate of three shillings the cubic half inch. About 1791 its elasticity recommended it to notice as a material for clothing, and one Samuel Peat obtained a patent for India-rubber cloth. Its waterproof qualities soon brought it into more extensive use; and as its numerous valuable properties were successively discovered, it was manufactured into pipes and tubes, cylinders, and cushions, cloaks and canes, rings, varnish, combs, paper-knives, bottles, goblets—in fact, into a hundred useful articles; so that, whereas we only imported, in 1850, 7617 cwts., in 1864 we imported 71,027.

Caoutchouc is diffused, in the form of minute globules, in the milky juices of plants, and especially in those of the natural orders *Apocynaceæ*, *Artocarpaceæ*, *Asclepiadaceæ*, *Euphorbiaceæ*, *Moraceæ*, and *Papayaceæ*. It is only in warm climates that it occurs in sufficient abundance to become available for commercial purposes, and the caoutchouc employed in Europe comes either from the East Indies or South America.

In the East Indies it is principally obtained from the India-rubber tree,* which has been successfully transferred

* Ficus elastica; order *Moraceæ*.

to our English "crystal palaces," from the woody rocks and hills of Sylhet. It is a tree of more than average stature, abounding in large oval leaves, very thick and shining. You might shelter a herd of cattle under one or two of these noble trees. The milky juice is extracted by making incisions through the bark and down to the very wood, cutting all round the stem or branch, at intervals of twelve or fifteen inches. Thirty ounces of caoutchouc are distilled from thirty ounces of the juice.

But the caoutchouc tree, properly so called, is of South American birth, and belongs to the natural order *Euphorbiaceæ*. It is one of the principal ornaments of the immense forests of Guiana and Brazil, where it rears its tall, straight, column-like branch to the height of sixty feet, terminating in a noble crown of leafy branches. Its juice is obtained through incisions in the bark, and collected on pear-shaped or bottle-like moulds of clay, which are afterwards dried in smoke, so as to receive a black colour. Layers of juice are successively applied and blackened, until the proper thickness is secured; and when the caoutchouc has sufficiently united, the mould is broken, and the india-rubber remains, fit for use.

Caoutchouc of the finest quality is supplied by the fine Sumatran tree, *Urceola elastica;* and other caoutchouc-bearing trees are: in South America, *Collophora utilis*,* *Cameraria latifolia;** in East Indies, *Willughbeia edulis;** and in Madagascar, *Vahea gummifera*.*

Chemically speaking, caoutchouc is a compound of carbon and hydrogen. It is a tenacious, fibrous, and remarkably elastic substance, which hardens at the temperature

* Order *Apocynaceæ*.

of freezing water (32° Fahrenheit). It softens in boiling water. If suddenly stretched out to seven or eight times its proper length, it becomes warm; and if kept so for several weeks, loses nearly all its elastic characters. In this state it is cut into thin strips and used as "elastic." It is insoluble both in water and alcohol, but may be dissolved by ether, chloroform, naphtha, lavender, sassafras, oils of turpentine, benzole, crude petroleum, and bisulphuret of carbon. It fuses at 248° Fahrenheit, and at 600° becomes volatilized, yielding a liquid called *caoutchouchine* or *caoutchisine*, remarkable for its great solvent properties.

THE CAOUTCHOUC TREE.

When spending an hour or two in that realm of true enchantment, the Royal Botanic Gardens at Kew—"Armida's Gardens," more full of wonder and beauty than the fable-land which Tasso, the Italian poet, has sung

of—we have observed with what eager interest lads and lasses have gathered round the specimens there collected of the *Nepenthes* or *Pitcher-Plants*.* It is probable that but few of those who examine them with such curious eyes know anything of their real character, or could positively tell you whether the curious appendages distinctive of these plants are leaves or flowers. It is not good to be ignorant of such things, and learned in Greek Verbs or Algebraic Equations. For the reader's benefit, therefore, we supply a few particulars.

Botanically speaking, and indulging, as botanists are forced to do, in scientific language, the Nepenthes form the only known genus of a natural order of exogenous plants called Nepenthaceæ, consisting of herbaceous or half shrubby plants with dicœcious flowers. Like many other vegetable wonders, their native home is the warm region of India and China, where they flourish in swampy places. There are twenty species, and they are most abundant in the tropic islands of Borneo and Sumatra; islands where Nature seems to have lavished all she could conceive of curious and rare. One species only, the *Nepenthes distillatoria*, is found in Ceylon; two belong to Madagascar, and another flourishes on the Khasian mountains.

The pitchers, from which they derive their name, are supported by a stalk, which apparently springs from the apex of the leaves, or they may be, perhaps, the true leaves themselves. On this point botanists differ. Dr. Hooker regards the pitcher as simply a prolonged modification of the midrib of the leaf, and we think he is right. It is a capital pitcher, however, with a light-lifting lid,

* Order *Nepenthaceæ*.

and as capable of holding water as any vase ever fabricated by potter! As the plant grows old the lid opens, and never closes again.

The water contained in these strange natural goblets is secreted by certain small glands at the base of the cavity, and in sufficient quantity to drown the flies and other insects which fall into it. Doubtless it provides in some mysterious way for the nourishment of the flower which secretes it, and which thus satisfies its wants with its own moisture! A beautiful and interesting object is one of these remarkable plants, with its bright green colour, and its "light and airy appendages."

PITCHER PLANT (*Nepenthes distillatoria*).

The species chiefly cultivated in English hot-houses are *Nepenthes distillatoria*, *Nepenthes Rafflesiana*, and *Nepenthes ampullacea*. Their pitchers differ in size and shape, some being six or eight inches long, and finely marked with rich brown spots. But in every form of life, animal or vegetable, there exists a type of superior beauty and

magnitude, and this, among the Nepenthes, is found in a recently-discovered Bornean species, named the *Nepenthes Rajah*, by Dr. Hooker of Kew, in honour of a gallant Englishman, Sir James Brooke, the Rajah of Sarawak. The pitcher is twelve inches long by six broad; the blade of the leaf, eighteen inches long by eight broad; and the midrib nearly or quite as thick as the middle finger. It is unfortunate that, as yet, no living specimen has reached England; but an imperfect leaf and pitcher, dried, may be seen in the Kew museum.

The young classical student must not confound these plants with the *Nepenthes* of Homer—the magic potion (*νηπενθής*) which removed from the soul all remembrance of pain and sorrow. This was probably some preparation of hemp.

The water collected in the pitchers has, when boiled, the odour of baked apples; and, on evaporation, leaves a residuum of minute crystals of binoxalate of potash.

So much for the true pitcher-plants; but Mr. Jackson observes that others occur in families totally unconnected with the Nepenthaceæ. Thus, in the *Side-saddle flower* order *—an order peculiar to North America—herbaceous perennial plants growing in marshy soils—we have the genera *Sarracenia*, *Darlingtonia*, and *Heliamphora*, all forming perfect but variously-shaped pitchers: with this difference, however, that the pitchers are not appendages to the leaves, but the leaves themselves, united at the edges. It is from the shape of the leaves that the name "Side-saddle flower" is derived. The order has no known properties or economic value.

* Sarraceniaceæ.

The pitchers are usually nearly full of water, which we may suppose to be secreted by the plants. They are even better insect-traps than the Nepenthes, for round their mouths lies a glutinous or saccharine exudation, while the portion immediately below is perfectly smooth, but nearer the bottom runs a series of sharp reflexed hairs. The sugar attracts the flies, which incontinently slide down the smooth surface into the water, and are prevented from saving themselves by the hairs. Do the dead insects in any way provide for the nourishment of the plant?

In the swamps of Australia, and especially in the vicinity of King George's Sound, English travellers have observed a remarkable little plant, with bright green leaves, and a spike of clustering flowers, called the *Cephalotus follicularis*. It is surrounded by a row of pitchers, which apparently rest on the ground, as if to protect the leaves and flower-spike from injury. The leaves themselves are spoon-shaped, and green like the pitchers, which, however, are marked with small brown or purple spots. The mouth resembles that of the pitchers of the Nepenthes, having a thickened rim, and being notched in a very regular manner.

But we have omitted one of the most curious of the Sarraceniaceæ—the species called *Darlingtonia Californica*—a perennial herb growing in marshy places in California. Its pitcher is a marvel of vegetable ingenuity.

Near the orifice, says Mr. Jackson, it curves over, forming a perfect hood; and it is from the inner edge of this hood, on the under side, that the true leaf springs.

This leaf is very deeply divided, or two-lobed, the lobes spreading out and hanging downwards. The entrance to

the pitcher is under the curved hood, which, to some extent, affords a protection for the orifice; and though, just inside, the circumference is studded with short, sharp hairs, insects have frequently been found dead at the bottom of the pitcher.

From the position of the vaulted hood over the mouth of the pitcher, completely excluding rains, dews, or other atmospheric moisture, botanists have arrived at the conclusion that the liquid found must, as in the case of the Nepenthes and the Sarracenia, be secreted by the plant itself; an arrangement which, we think, the reader will admire as a strange and remarkable provision of Nature.

Not inferior in utility and importance to any of the products of the Vegetable World previously described is the *Bread-fruit tree*,* a native of the Indian and Pacific Oceans, and a slender tree, forty to fifty feet high, and for half its height without a single branch. Its leaves, a foot and half in length, are large, pinnatifid, dark green, and lustrous. Its fruit, composed of consolidated fleshy calices, is covered with a roughish rind, is of an oval shape, about the size of a child's head, and contains a number of almond-like nuts. At first the fruit is green; when half ripe, brown; and when mature, of a golden yellow. A short thick stalk attaches it to the branches of the tree, and it hangs either singly or in groups of two or three together. The pulp, in its earliest stage, is white, mealy, and consistent, like new bread.

The old navigator, Dampier,† describes this tree in his usual quaint fashion:—

"It grows," he says, "on a large tree, as big and high

* Artocarpus incisa; Order, *Artocarpaceæ*. † Dampier, "Voyages."

as our largest apple trees: it hath a spreading head, full of branches and dark leaves. The fruit grows on the boughs like apples: it is as big as a penny loaf when wheat

BREAD-FRUIT TREE (*Artocarpus incisa*).

is at five shillings the bushel: it is of a round shape, and hath a thick rough rind: when the fruit is ripe, it is yel-

low and soft, and the taste is sweet and pleasant. The natives of Guam use it for bread. They gather it, when full-grown, while it is green and hard; then they bake it in an oven, which scorcheth the rind and makes it black; but they scrape off the outside black crust, and there remains a tender, thin crust; and the inside is soft, tender, and white, like the crumb of a penny loaf. There is neither seed nor stone in the inside, but all is of a pure substance like bread. It must be eaten new; for if it is kept above twenty-four hours, it grows harsh and choaky, but is very pleasant before it is too stale. This fruit lasts in season eight months in the year, during which the natives eat no other sort of food of bread kind. I did never see of this fruit anywhere but here (the island of Tahiti, or Otaheite). The natives told us that there is plenty of this fruit growing on the rest of the Ladrone Islands; and I did never hear of it anywhere else."

The reports which were circulated of the beneficial properties of this tree induced the West Indian merchants to petition the British Government for its introduction into the Antilles. For this purpose the *Bounty*, a ship of 215 tons, was equipped in 1787, and, under the command of Lieutenant Bligh, dispatched to Otaheite (or Tahiti, as it is now, and more properly, called) to obtain a cargo of trees, for transport to the West Indies. The object of the expedition was frustrated by the outbreak of the famous mutiny. Bligh and eighteen of his officers and crew were flung into a small boat, in which they successfully accomplished a voyage of 3618 miles to the isle of Timor, while the mutineers, after various misadventures, established themselves on Pitcairn's Island. A second expedition,

however, was more successful, and the bread-fruit tree was happily naturalized in the West Indian Archipelago.* But of late it has been superseded by the banana, which the negroes consider of a better flavour.

Mr. Wallace, in his recent work on " The Malayan Archipelago," furnishes an agreeable description of this celebrated tree:—" Though it grows," he says, " in several other parts of the archipelago, it is nowhere abundant, and the season for it only lasts a short time. It is baked entire in the hot embers, and the inside scooped out with a spoon. I compared it to Yorkshire pudding; Charles Allen said it was like mashed potatoes and milk. It is generally about the size of a melon, a little fibrous towards the centre, but everywhere else quite smooth and puddingy, something in consistence between yeast-dumplings and batter-pudding. We sometimes made curry or stew of it, and fried it into slices; but it is no way so good as simply baked. It may be eaten sweet or savoury. With meat and gravy it is a vegetable superior to any I know, either in temperate or tropical countries. With sugar, milk, butter, or treacle, it is a delicious pudding, having a very slight and delicate but characteristic flavour, which, like that of good bread or potatoes, one never gets tired of. The reason why it is comparatively scarce is, that it is a fruit of which the seeds are entirely aborted by cultivation, and the tree can therefore only be propagated by cuttings."

As yet we have scarcely done more than hover about the confines of my subject, which, in truth, to receive full justice, would occupy, not one small octavo, but half-a-dozen quartos! Probably not a single plant exists which,

* " Mutiny of the Bounty" (" Family Library").

if its properties were fully understood, would prove to be useless to the "lord of creation." Assuredly not a single plant exists which does not play some important and indispensable part in the grand economy of nature.

Let us turn to the *Sphagna*, or Bog-mosses, which spread in such immense quantities over damp heaths and absorbent soils, filling up the beds of ancient lakes and ponds "with dense, spongy, continuous cushions, of a pale green, dirty white, or dark red colour." These mosses act like sponges, and imbibe the moisture from the atmosphere, and the rains as they fall; then they decay, and accumulate their débris on the soil which nourished them; the quantity increases yearly, is slowly carbonized, and finally constitutes the substance called *peat*, which, in some countries, is largely employed as fuel.

The *Sphagnum*, or bog-moss, which undergoes this remarkable transformation, is of a singularly pale, almost a snow-white colour, and sometimes attains a length of six or seven feet in deep water, the necessary buoyancy being imparted by its large air-cells.

"Its structure," says Mr. Macmillan,* "differs in many respects from that of all other mosses. Its branches are *fasciculate*, and disposed around the stem in spirals; it is wholly without roots, but floats unattached in an upright position in the water; its cell-walls are perforated, and the leaf-cells contain a well-developed spiral, while the stem is composed of tissue, which, under the microscope, bears a curious resemblance to the glandular structure of the stems of coniferous trees. The seed-vessel is half concealed among the leaves, and bursts in the centre; the lid flying

* Macmillan, "Footnotes from the Page of Nature."

off when the seed is ripe with a report which is distinctly audible on a still summer day." Though extensively distributed in temperate regions, it is almost unknown in the Tropics, where peat is formed by the decomposition of

A Mossy Hut.

shrubby plants resembling our Scottish heather. But the peat of Tierra del Fuego, the Falkland Islands, and the Galapagos Archipelago, is composed of this bog-moss. Of its importance the reader may form some idea, by bearing in mind that peat-bogs occupy a tenth part of the whole surface of Ireland, and furnish in the Scottish Highlands the largest proportion of the fuel consumed by the inhabitants.

When the soil is not excessively saturated, the Sphagna give place to what we may call the Mosses proper. Are any of these useful? Inestimably so; if it were only for the air of beauty with which they invest the rock and the desert; if it were only for the intellectual gratification provided by their exquisite conformation; if it were only for "the wealth of wisdom" which lies

> "Within one moss-cup's mysteries,"

for the exquisite fancies and suggestions which are naturally originated by these

> "Urns of beauty, forms of glory,
> Shapes with frosted silver hoary."

But they are "useful" in a more ordinary and commonplace meaning of the word. Certain species are employed in the manufacture of mats and brooms and mattresses; the dense "fork-moss" is twisted by the Esquimaux into lamp-wicks; the Laplanders make a coarse kind of bread out of various kinds. The liverwort is said to be of some value as a remedy in jaundice and other maladies of the liver. The beautiful Lycopods are used for chemical purposes, and in the Highlands, with alum, to fix the native dyes in the manufacture of tartan. But the so-called *Iceland-moss* * is really a lichen. Its excellence as a restorative diet for invalids is well known.

The fair blooming *Heather*, so celebrated in Scottish poetry, and not forgotten by our English minstrels, one of whom exclaims,

> "How many a vagrant wing light waves around
> Thy purple bells!"

is not without a practical value, being made—as everybody

* Cetraria Islandica.

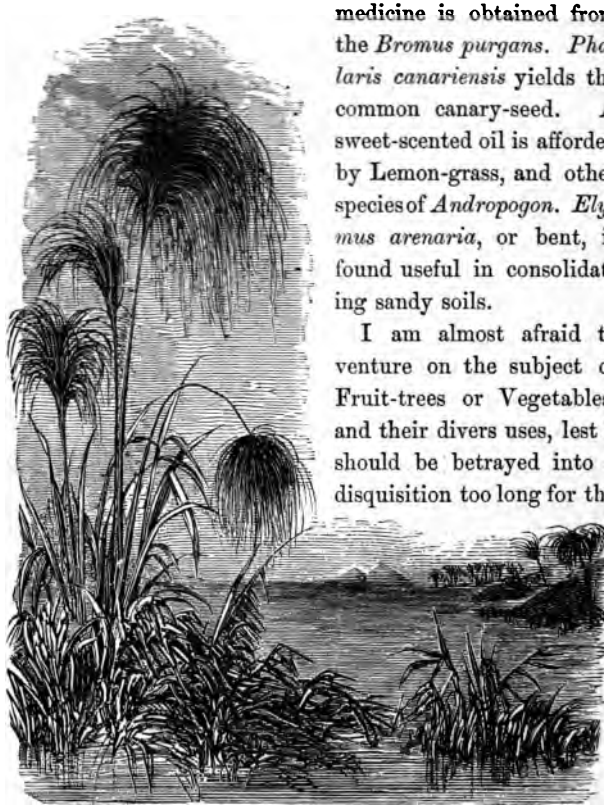
knows—into brooms, and also employed—as everybody does not know—for dyeing. In sandy countries, however, the heaths, or *Ericæ*, are of a still more important use. Their débris, accumulating on the soil, ameliorate and enrich it. At first the rain-water pours through the sand as through a filter; afterwards, it is compelled to stagnate through the interposition of organic matters; and, in course of time, districts formerly barren are transformed into valuable peat-bogs, or with a soil capable of rewarding the husbandman's toil with the richest results.

Few plants of the Sedge family * are attractive to the eye, yet their utility calls for man's most graceful acknowledgments. The creeping stems of the *Carex arenaria* bind together the shifting sand-hills on the shores of Brittany and Holland, until they are united into a compact mass, capable of defying wind and wave. The *Papyrus* of the Nile, whose cellular tissue formerly furnished the world with paper, belongs to this class. Some of the species have tubers attached to the lower part of their stems, which are used as food. The roots of *Cyperus longus* furnish a medicinal tonic.

What shall we say of the Grasses? † I do not refer to the great Cereals, such as wheat and barley, oats, rice, maize, rye, millet, and Guinea corn, whose absolute benefit to man cannot be summed up in a few lines. Nor do I refer to those which serve as herbage for animals, ranging from the meadow and rye grass of our own green fields to the Kangaroo grass of New Holland, and the Tussac grass of the Falkland Islands; the former a few inches, and the latter five to six feet in height. I do not even allude to

* Order *Cyperaceæ*. † Order *Gramineæ*.

the Saccharine grasses, as the Sugar-cane and the sweet Sorgho; but to the less known and less important species, which, though not indispensable to human happiness, possess a positive and distinct value. Beads, for instance, are made from the grains of *Coix Lachryma*; a cathartic medicine is obtained from the *Bromus purgans*. *Phalaris canariensis* yields the common canary-seed. A sweet-scented oil is afforded by Lemon-grass, and other species of *Andropogon*. *Elymus arenaria*, or bent, is found useful in consolidating sandy soils.



THE PAPYRUS OF THE NILE.

I am almost afraid to venture on the subject of Fruit-trees or Vegetables, and their divers uses, lest I should be betrayed into a disquisition too long for the

few pages remaining at my command. I will glance, however, at some of the leading facts, in the hope the reader may afterwards be induced to study the question in all its bearings.

The *Potato*, which, it is said, Sir Walter Raleigh introduced into England, but which was more probably imported by Sir John Hawkins, in 1563, is cultivated in almost all temperate countries; its nutritive properties are due to the *fecula* it contains.

The farina drawn from the roots of the *Manioc* is used for food, under the name of Cassava bread, in Brazil, Guiana, the East Indies, on the west coast of Africa, in New Caledonia, Tahiti, and other sub-tropical regions.

The tubers of several kinds of *Yam* * contain a large quantity of fecula,† and are eaten by the inhabitants of China, Japan, the Indian Archipelago, and Guiana.

Accumulated in the pith of several palm-trees and species of cycas is found a large proportion of this fecula, or starch, which has received the name of Sago. It is principally prepared from *Sagus genuiana*, *Sagus lavis*, and *Saguerus saccharifer*, in the Indian Archipelago; *Phœnix farinifera*, on the Coromandel coast; *Caryota ureus*, in Assam; and the Talipot palm, in Ceylon.‡ To obtain it, the trees are cut down; the stems divided into lengths, split open; the pith dug out, cut small, placed in a wooden vessel, and washed with clean water; the deposit, when dried, forms the ordinary *Sago flour* of commerce. A granulated kind of sago from India is known as *Tapioca*.

* Order *Dioscoreaceæ*.

† The term *fecula* is applied to certain products furnished by the subterraneous parts of a plant.

‡ See *ante*, p. 101.

Certain varieties of *Marantaceæ*, natives of tropical regions, are distinguished by their tuberous rhizomes, or root-stocks, whose edible and nutritious fecula bears the well-known designation of *Arrow-root*—from a belief that it was valuable as a remedy for wounds produced by poisoned arrows. The best West Indian arrow-root comes from Bermuda. *Tous-les-mois* is the produce of *Canna coccinea*, *C. edulis*, and other species of *Canna*.

The *Batatas edulis*, or *Convolvulus Batatas*,* yields the Sweet Potato, which contains a considerable quantity of nutritive matter, and is used as food in the East and West Indies, and Cochin China.

The double twisted root of Bistort, or *Polygonum bistorta*,† contains tannin, gallic acid, and starch, and forms a large proportion of the vegetable food of the Esquimaux.

Numerous fungi are eaten in France, Germany, Italy, and Russia; such as the common Mushroom, the Morell, the Truffle, and the *Agaricus Prunulus*. Many species of *Boletus* form a staple article of the diet of the West Australian aborigines. *Mylitta australis* is called in Australia "Native Bread." According to Dr. Darwin, the inhabitants of Tierra del Fuego almost wholly live on a globular fungus of a bright yellow colour (*Cyttaria Darwinii*), which grows on the bark of the beech.

How inexhaustible a theme would be afforded me in Salads. How much I might say of radishes, lettuces, onions, cresses, endive, celery, beet-root, and the like!

Then — Vegetables! What would our dinners and

* Order *Convolvulaceæ*. † Order *Polygonaceæ*.

suppers be without them? Conspicuous by their absence, we should gaze regretfully on the ill-supplied table. They have always held an important place in man's bill of fare, and their nutritive and stimulating properties are not easily over-praised. Charlemagne, the great Western Emperor, is said to have cultivated them with his own hand. In ancient times, indeed, the highest honours were paid to them.

Among these products some contain a quantity of nutritive matter which renders them scarcely less valuable as food than bread or meat. The azotised principle of peas, haricots, beans, and lentils, is named legumin.

It should be noted that the *Indian haricot* was first made known to Europe by Alexander the Great. *Green peas* were not used as food in France until the middle of the sixteenth century; some years later their edible qualities found appreciation in England.

The *Cabbage* was so highly esteemed by the Egyptians that it was the first "course" at all their repasts. It was not less valued by Greeks and Romans. Cato pronounced it a remedy for all evils; Erasistatus recommended it as a panacea for paralysis; and Hippocrates as a cure for colic. *Asparagus* was anciently cultivated on a very extensive scale; its stems, in the Roman gardens, weighed three pounds each. *Turnips* and *carrots* are still eaten for their nutritious qualities. *Broccoli* was, and is, a favourite vegetable. It is said that the Emperor Tiberius and his son Drusus were so inordinately partial to this plant, that a dish of it immediately set them quarrelling for its possession.

Many plants are or were held to be available for a two-

fold purpose; as seasoning or in sauces, to promote one's appetite—and as medicinal remedies, to improve or restore one's health. Thus: fennel was counted good for the eyesight; dill was said to strengthen the stomach; wild thyme cured the bite of serpents; pennyroyal dispelled spasms and indigestion. Mint is still in high favour with the physician as well as with the cook; and ginger is valuable as a drug, and appetizing as a condiment.

We come to the chapter of *Fruits*. The most common are, Apples, Oranges, Figs, Almonds, Chestnuts, Grapes, Melons, Lemons, Pears, Cherries, Plums, Peaches, Apricots, Strawberries, Raspberries, Gooseberries, Currants, and Olives.

The *Olive* has always been the emblem of peace, and among the ancients was sacred to Minerva. It was transplanted from Judæa into Greece; from Greece into Rome; from Rome into Spain. "The Ancona olives," says Dr. Doran, in his entertaining volume on "Table Traits," "were the most highly esteemed by the Roman patricians, at whose tables they opened and closed the banquet. While the olives were greedily swallowed, the expressed oil was distributed by way of largess to the people. It was declared to possess, if not a vital principle, something that stimulated and maintained vitality. Augustus, who was even hoping that he might die easily, once inquired of Pollio how he might best maintain his health and strength in old age. 'You need do nothing,' replied Pollio, 'but drink abundance of wine, and lubricate your body with plenty of olive oil!'"

Most of the fruits which figure on our English tables are exotics—strangers originally to our British soil—and

THE OLIVE-TREE (*Olea Europea*).

only naturalized through the skill and attention of the horticulturist. The *Cherry* originally came from Cerasus, in Asia, and came into England through Italy. The cherries of Kent, Oxfordshire, and Berkshire are now fit rivals, however, for any of foreign growth. The *Apricot* is an Armenian; the blushing *Peach*, a Persian. The *Plum* was anciently cultivated at Damascus, though certain species seem to be derived from Africa. The *Apple* came from Asia, according to some authorities; according to others, it is an African, and reached Normandy through Spain and France. From the Celestial Empire we trace the westward career of the *Orange;* the *Quince* is a native of Cydon, in Crete. The Athenians claimed the *Fig-tree*

as indigenous to the soil of Attica; but it was probably brought from a region further east.

Dates, Ananas, and Indian Figs are all of tropical origin, and enter very largely into the ordinary diet of Asiatic and African nations, as we have shown in an earlier portion of the present volume.

To the great *Laurel* family, or *Lauraceæ*, belong many plants of the highest utility. Some furnish camphor; others yield volatile and fixed oils; and the barks of others are gifted with tonic and astringent properties. Well known to every one is the glossy Sweet Bay, or Victor's Laurel—the *Laurus nobilis*, whose leaves were used to crown the successful winner and the competitor in the Olympic Games. The Camphor-tree (*Laurus camphora*), a native of China, Japan, and Cochin-China, supplies the useful medicinal drug of the same name. Even more valuable is the fragrant product of the Cinnamon-tree (*Cinnamomum zeylanicum*), which grows abundantly in Ceylon, attaining the height of thirty feet. Its bark supplies the cinnamon so much esteemed by our cooks and druggists. Cassia bark is obtained from the *Cinnamomum cassia* of China. The succulent fruit called Avocado or Alligator pear, comes from the *Pasea gratissima*—a tree which flourishes in the tropical and sub-tropical regions of Asia, Africa, and America.

The *Cacao-tree*, a member of the Byttneria family (or *Byttneriaceæ*), flourishes in the green depths of the forests of Equatorial America. Its seeds are called Cacao-beans; and when roasted and pounded and mingled with sugar, vanilla, and cinnamon, constitute the substance called Chocolate, which forms an essential part of the economy

of the breakfast-table. The fruits of this tree are gathered twice a-year, in December and in June.

Cacao Pod.

The nutritive properties of chocolate were so highly valued by Linnæus, the great Swedish botanist, that he christened it *Theobroma*, or "a drink for the gods." Its native name Chocolatl, was given to it in Mexico, whence it was introduced into Europe by no less distinguished a person that Fernando Cortez, the great Spanish conqueror. It owes its excellent qualities to the oil or butter of cacao which it contains.

Of great importance as an article of food is the fruit of the *Mango-tree*—originally born and bred in Hindustan, but now successfully cultivated in the Mauritius, the West Indies, and Tropical America. In size it resembles a small melon; its flesh is of a yellow colour, and somewhat fibrous; but the inhabitants of the Tropics find its taste delicious.

In the East and West Indies much favour is shown to the products of various species of Anona, such as *A. squamosa* and *A. reticulata;* their popular name is Sweetsops, Soursops, and Custard-apples. The Chermioyer, a well-known Peruvian fruit, is furnished by the *Anona chermiolia*.

The *Anacardiaceæ*, or Cashew-nut family, number

forty-one known genera, and ninety-five distinct species. One of this family, a native of the Moluccas, is the celebrated *Anacardium occidentale*, remarkable for the juicy and fleshy stalk, or peduncle, from which depends the fruit or nut. A distant relation, well-known in Asia, and cultivated also in the south of Europe, bears the name of the *Pistachio-nut*. Its green-coloured oleaginous kernels figure as an article of diet in the "Arabian Nights' Entertainments." A lamb stewed with these nuts seems to have been a dish held in special favour.

Chian turpentine is the resinous liquid which exudes from the *Pistacia terebinthus* of Chio—a tree which grows to the height of 30 or 35 feet, and wears a crown of glossy leaves. Mastic comes from the *Pistacia lentiscus*, a native of the Mediterranean shores and islands.

The West Indies claim as their own the *Achras sapota*, which furnishes the well-known Sappodilla Plum and Naseberry. *Bassia Parkii*, belonging to the same family, is of African birth, and yields the famous "Shea butter," of which one reads so much in the writings of early African travellers—Park, Lauder, Denham, and Clapperton. The *Machuca-tree* supplies a similar oily matter, which is used as butter in Nepaul. Gutta-percha, now so extensively employed in manufacture, is the product of the *Isonandra Gutta*.

In a preceding page we have referred to the *Bertholletia excelsa* and the *Lecythis ollaria*, both of them colossal trees, the ornaments of the forests of Tropical America; the former produces the woody capsules called Monkey-pots, and the latter the well-known fruit named Brazil-nuts. They belong to the *Myrtaceæ*, or Myrtle family; a

family which counts seventy-seven known genera, and upwards of fourteen hundred species—many of them highly useful. Cajeput oil, which possesses the property of dissolving caoutchouc, is of a grass-green colour and has a pungent camphor-like odour. It is expressed from the leaves of a native of the Molucca Islands, the *Melaleuca minor*.

In this family are included the gigantic gum-trees of Australia, the *Eucalypti*, some of which attain a height of two hundred feet. From the *Eucalyptus resinifera* comes the astringent resinous-like substance, called Botany-Bay Kino. As much as sixty gallons are procured from a single tree. The valuable drug and condiment known as Cloves is produced by the flower-buds of a tree, the *Caryophyllus aromaticus*, which was originally a native of the Molucca Islands, and jealously guarded by the Dutch, but is now cultivated in both the East and West Indies.

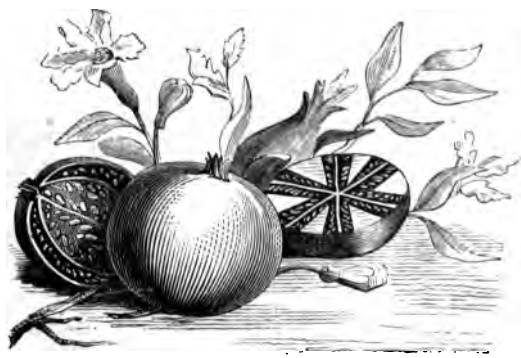
The berried fruit of the *Eugenia Pimenta*, a native of the West Indies and Mexico, furnishes our aromatic pimento, Jamaica pepper, or allspice; so called because its taste combines the peculiar savour of cloves, cinnamon, and nutmeg.

Nor in this connection must we forget the Betel-nut, which, as a species of stimulant, is much used in the Indian Archipelago. Hear what a recent traveller, Mr. Bickmore, has to say respecting it:—"The nut," he tells us, "which resembles a nutmeg, is chewed with a green leaf of the *siri*, *Piper betel*, which is raised only for this purpose; and such great quantities of it are consumed in this way, that large plantations are seen in Java solely

devoted to its culture. The mode of preparing this morsel for use is very simple: a small quantity of lime as large as a pea is placed on a piece of the nut and enclosed in a leaf of siri. The roll is taken between the thumb and forefinger and rubbed violently against the front gums, while the teeth are closed firmly, and the lips opened widely. It is now chewed for a moment, and then held between the teeth and lips so as to partly protrude from the mouth. A profusion of red brick-coloured saliva now pours out of each corner of the mouth, while the man is exerting himself at his oar or hurrying along under a heavy load. When he is rich enough to enjoy tobacco, a small piece of that luxury is held with the siri between the lips and teeth. The leaf of the tobacco is cut so fine that it exactly resembles the 'fine cut' of civilized lands, and long threads of the fibrous oakum-like substance are always seen hanging out of the mouths of the natives, and completing their disgusting appearance. This revolting habit prevails not only among the men but also among the women; and whenever a number come together to gossip, as in other countries, a box containing the necessary articles is always seen near by, and a tall urn-shaped spit-box of brass is either in the midst of the circle or passing from one to another, that each may free her mouth from surplus saliva. Whenever one native calls on another, or a stranger is received from abroad, invariably the first article that is offered him is the siri-box."

Among the Myrtaceæ is also counted the beautiful *Punica granatum*, or Pomegranate-tree, whose dark scarlet flowers contrast so vividly with its emerald foliage, and to whose luscious fruit the scriptural references are so numer-

ous. "The outside rind," says Dr. Thomson, "is thin but tough, and its bitter juice stains everything it touches with an undefined but indelible blue. The average size is about that of the orange. Within, the grains are arranged in longitudinal compartments, as compactly as



POMEGRANATES.

corn on the cob, and they closely resemble those of pale red corn, except that they are nearly transparent and very beautiful. They are ripe about the middle of October, and remain in good condition all the winter.

"The flower of the pomegranate," adds our authority,* "is bell or tulip-shaped, and of a beautiful orange-red, occasionally deepening into crimson.

"This fruit was highly valued in ancient times, and Moses refers to it (Deut. viii. 8) as one of the excellencies of the Promised Land; and, by divine command, he was to make pomegranates on the hem of the ephod—a golden bell, representing the blossom, and a pomegranate alter-

* Dr. Thomson, "The Land and the Book."

nately round about the hem of the robe; and they were reproduced in the Temple, upon the network that covered the capitals on the summit of 'Jachin and Boaz'—those magnificent pillars of brass—two hundred pomegranates forming a gorgeous ring."

LEAF AND FRUIT OF THE VINE.

Nearly all our fermented liquors are obtained from plants.

Wine, which has been the theme of so much poetical panegyric, is, as everybody knows, the juice of the grape, and to enlarge upon its properties would be a labour of absolute supererogation.

The *Vine* is, by birth, a Persian. "Its cradle," says Dr. Doran, "was on the sunny slopes of the hilly regions on the south shores of the Caspian Sea. There, in the Caucasus, and in the romantic valley of Cashmere, the wild vine still climbs and clings to the topmost branches of the loftiest trees. In ancient days, moreover, Palestine was famous for the glory of its grapes. Clusters are spoken of, each exceeding a stone in weight; and vines are mentioned whose stems measured a foot and a half in diameter, and whose height reached to thirty feet; their branches affording 'a tabernacle of shade' to the extent of thirty feet square."

Gathering the grapes, in Eastern and Southern countries, is a peculiarly picturesque and attractive spectacle, as may be inferred from the fine description painted in glowing colours by Robert Browning:—

"In the vat half-way up in our house-side
Like blood the juice spins,
While your brother, all bare-legged, is dancing
Till breathless he grins
Dead-beaten, in effort on effort
To keep the grapes under,
For still when he seems all but master
In pours the fresh plunder
From girls who keep coming and going
With basket on shoulder,
And eyes shut against the rain's driving,
Your girls that are older—
For under the hedges of aloe,
And where, on its bed
Of the orchard's black mould, the love-apple
Lies pulpy and red,
All the young ones are kneeling and filling
Their laps with the snails
Tempted out by the first rainy weather—
* * * *
Meantime, see the grape-bunch they've brought you—
The rain-water slips
O'er the heavy blue bloom on each globe
Which the wasp to your lips
Still follows with fretful persistence."

Cider, which many a good judge prefers to champagne, is the fermented juice of crushed apples. Herefordshire and Devonshire are the two counties which produce the finest brewage. *Perry* is obtained from pears; beer, in all its varieties, from skilful combinations of malt and hops. Home-made wines are very popular among the middle class of English society; and one of these innocent liquors, Gooseberry-wine, has obtained immortality at the hands of Oliver Goldsmith. Who does not remember its excellence as manufactured by Mrs. Primrose!

In Norway a wine is made from the fermented sap of the birch-tree; the *Quass* drunk by the Russian peasants, is obtained from the shooting rye. From the saccharine sap of the American Sugar-maple (*Acer saccharinum*), Maple-wine is manufactured. Good vinegar is also made from it, and a kind of molasses, said to be much superior to that from the sugar-cane. The wood of the sugar-maple, let us add, has a peculiar satiny appearance, and is employed in cabinet-making. When marked by certain undulations of fibre, it is known as Bird's-eye Maple.

MAPLE (*Acer saccharinum*).

The fermented juice of the sugar-cane is consumed in the West Indies under the names of *Guarapo dulce*, and *Guarapo forte*, according to the degree of its alcoholized strength.

From the sap of the American Aloe (*Agave Americana*) the inhabitants of Peru and Mexico distil an intoxicating

beverage, called *vino de Palque*, which often proves fatally injurious to their lives and fortunes. The sugar obtained by inspissation from the juice is diluted with water, and subjected to four or five days' fermentation.

Maize, pounded, fermented, and diluted with water, yields, among the American Cordilleras, a drink named *Chicha;* or, if the maize has been roasted, and sweetened with sugar, *Masato*. A beverage known as *Guamzo* is similarly distilled from rice; and the people of Guiana procure a stimulating liquid, called *Cachéry*, from Cavassa and the Batatas.

Palm-wine is yielded by several species of Palm; in the neighbourhood of Tripoli it is designated *Lagbi;* in some parts of China, *Cha;* and in Hindustan, *Sinday*. The grains of the Sorghum or Durra (*Andropogon Sorghum*), when fermented, produce a beverage which the Chinese have named *Kao-lyang*.

The intoxicating effects of *Hash-i'sh*, prepared from the flowers and tender tops of Indian Hemp (*Can-*

TAPPING THE PALM.

nabis Indica), have been frequently described. It does not produce drunkenness, but a kind of happy indifference to the events of the external world; a mental and moral indolence, comparable to the state of the lotus-eater, if the extravagant statements of the poets might be accepted as truths. "The hashi'sh-eater is happy," says Dr. Moreau; "not like the gourmand or the famished man when satisfying his appetite, or the voluptuary in the gratification of his desires, but like him who hears tidings which fill him with joy; like the miser counting his treasures, the gambler who is successful at play, or the ambitious man intoxicated with success."

After all, however, that is a very indifferent and ignoble kind of felicity which depends on our abnegation of the moral duties, and our ignoring of the responsibilities of life. All true happiness lies in honest work. Have we not an eternity to rest in?—Who is the most to be congratulated? The man who from a secure post looks on unmoved at the eddies of the battle, and its varying fortunes—who gains nothing, and loses nothing, whatever may be the mighty issue; or he who plunges into the press and toils through the fray, carrying off as his guerdon the laurel-crown of victory?

Sugar can be obtained from a great number of vegetables, but the best is furnished by the well-known *Sugar-cane*, which, originally a native of Central and Southern Asia, is cultivated now-a-days in nearly all warm climates, and thrives especially in the West Indies. A saccharine product is also yielded by the beet-root; by the sap of the maple and the palms; the stems of maize, rice, and durra;

the fruits of the pumpkin; the tubers and underground parts of the potato, carrot, and turnips. Numerous fruits, such as grapes, figs, apricots, plums, are covered with little white efflorescences, which constitute a genuine

SUGAR-CANE PLANTATION.

sugar, though differing from that of the sugar-cane and the beet in this one circumstance—it does not crystallize; hence, it is scientifically termed *glucose*.

All parts of plants containing sugar will, after undergoing the process of fermentation, yield alcohol. The alcohol distilled from wine is generally called "spirits-of-wine," or "rectified spirit." By distilling the fermented liquids already named, or those of saccharine fruits, a great number of alcoholic products may be secured. A species

of brandy is extracted in Northern Europe from the potato. *Gin* is alcohol prepared from the berries of the juniper. The *Goldwasser* of Prussia is gin mixed with aromatic substances. The *Whisky*, or "mountain-dew," of Scotland and Ireland comes from the distillation of barley or rye. Potatoes and sloes have been employed for the same purpose. *Kirchenwasser*, or "cherry-water," is the result of the distillation of cherries, crushed and fermented, with their kernels. A similar process yields the favourite drink called *Maraschino;* the *Slivovitza* of Austria is produced by the distillation of fermented plums; the *Rakia* of Dalmatia by the distillation of the husks of grapes with various aromatics; *West Indian Rum* comes from molasses and the froth of the sugar-cane syrup; the *Tafia* of Guiana and the West Indies, from the distilled "wort" or "must" of the sugar-cane; the *Aqua ardiente* of the Mexicans seems to be a preparation of the intoxicating Palque; the *Watky* of Kamtschatka is a kind of rice-brandy; the *Arrack* of America results from the distilled sap of the cacao; the *Araki* of Egypt is prepared from that of the date palm.

Eau-de-vie, aqua-vitæ, "water of life"—as brandy is called, with an exaggeration which sometimes proves bitterly satirical—when aromatized by certain vegetable products, furnishes a vast variety of stimulating beverages or liqueurs, to which we can only allow ourselves a very brief allusion.

Curaçoa, for instance, is made from orange-peel digested in alcohol, sweetened, and mixed with cinnamon, mace, or cloves. *Ratafia*, from brandy, sugar, and the crushed fruits of the black currant. *Absinthe*, from the *Artemisia*

mutellina, or wormwood, distilled in spirits, and flavoured with orange-water and sugar. Its green colour is artificially procured. *Holland Bitters* is a compound of gentian, cinnamon, coriander, elecampane, and the like, macerated in sweetened gin.

We now direct our consideration to a couple of beverages of infinitely higher importance and greater value—Tea and Coffee; without which our tables would now-a-days seem indifferently furnished, though their introduction into Europe is of comparatively recent date.

THE TEA-PLANT (*Thea Viridis*).

The *Tea-plant* is a native of Asia, and in appearance resembles our favourite camellias. Botanists are not agreed whether there are two or three species, or only one. Mr. Fortune, a highly competent authority, asserts that the black and green teas from the northern districts of China are both obtained from the same species or variety, the *Thea viridis;* but that those in the neighbourhood of Canton are made from a species or variety which he calls

the *Thea Bohea*. According to other writers, the tea-plant cultivated in Assam makes a third species, *Thea Assamica*.

The quality of the tea is dependent on the season when the leaves are picked, and the manner in which they are prepared. Green tea is richer in essential oil and tannin than black tea. The former includes Twankay, Young Hyson, Hyson, Gunpowder, and Imperial; the latter, Bohea, Congou, Souchong, Oolong, and Pekoe.

It seems to have been known in Europe as early as 1133, when it was panegyrized by Oloarius, the German. After slowly rising into reputation among the Hollanders, Spaniards, and Germans, it was introduced into England, in 1666, by Lords Arundel and Ossory. It then sold at 60s. per pound, and its use was accordingly restricted to the wealthiest classes. Early in the eighteenth century, however, tea-drinking had become a recognized social rite, as we may infer from various passages in the poets of our so-called Augustan age. Pope speaks of a lady retiring into rural solitudes—

> "To part her time 'twixt reading and Bohea,
> To muse, and spill her solitary tea;"

and Young says of a fashionable beauty, that—

> "Her two red lips affected zephyrs blow,
> To cool the Bohea, and inflame the beau;
> While one white finger and a thumb conspire
> To lift the cup, and make the world admire."

We pass on to *Coffee*, which was first introduced into England in the middle of the seventeenth century. In 1652, a Greek, named Pasqua Rosee, who had been in the service of an English Turkey merchant, opened a coffee-house in London, at St. Michael's Alley, Cornhill.

The new beverage speedily became popular, and the coffee-houses the recognized meeting-places of the wits and beaux of the town. In Paris it was rendered fashionable by the Turkish ambassador, Soleiman Aga, who, at his assemblies in 1683, caused it to be served to his guests with all the luxurious minutiæ of Oriental fashion.

THE COFFEE-PLANT (*Coffea Arabica*).

The Coffee-plant, *Coffea Arabica*, belongs to the great family of the *Rubiaceæ*, and is therefore allied to Peruvian Bark and Madder. It is a native of Arabia and the borders of Abyssinia; but now-a-days grows successfully in Java, Berbice, Demerara, and Jamaica. Its bitter principle, Caffein, is identical with that of Tea, the *Thein* of chemists. The part used as a beverage is the horny albumen of the seed; the fruit is succulent.

Our rapid survey of the utilities of the Vegetable World brings us now to a brief consideration of Medicinal Plants. It has been said to be the great merit of Paracelsus that, by the introduction of laudanum into Europe, he procured the means of slumber and forgetfulness for the afflicted

and unhappy. Laudanum is prepared from opium, which is simply the thickened juice of the White Poppy (*Papaver somniferum*), a native of Asia Minor. It is obtained by making a circular incision in the fruits or heads of the poppy shortly after the petals have fallen. The juice oozes out, drop by drop; congeals; is duly collected, wrapped in poppy leaves, and exported. The best qualities come from Smyrna, Constantinople, Egypt, Persia, and India. When employed medicinally its effects are most beneficial; but when used as a stimulant, or in lieu of tobacco, it ruins its victim in soul, mind, and body.

THE OPIUM-PLANT (*Papaver somniferum*).

Tobacco, like opium, is used by the physician and the seeker of pleasure; is used both as a drug and as a means *pour passer le temps;* and exercises a beneficial or an injurious influence according to

the manner in which it is employed. It was introduced into France in the reign of Charles IX., by Nicot, the French ambassador at Lisbon, who presented it to Catherine de Medicis; and bestowed his name on the plant.

THE TOBACCO-PLANT (*Nicotiana Tabacum*).

Several species of the Nicotiana yield tobacco. The leaf most used in Europe is that of the *Nicotiana Tabacum*, a native of the warmer districts of the New World. It is an annual; grows to a height of six feet; and bears a dull red flower. Syrian and Turkish tobacco are prepared from *Nicotiana rustica;* the fine Shiraz tobacco from *N. Persica.*

The Nicotiana is a member of the Nightshade family, or the *Solanaceæ.* To this order belong the *Solanum Dulcamara*, Bitter-sweet Nightshade; *Atropa Belladonna*, Deadly Nightshade; *Hyoscyamus niger*, *Henbane*, a valuable narcotic, which can often be employed where laudanum or morphia would prove injurious; *Datura Stramonium*, Thorn-apple, whose leaves and seeds possess anodyne and antispasmodic qualities; *Capsicum*, which supplies chillies and Cayenne pepper; *Mandragora*

officinarum, Mandrake—to whose sedative influence Shakspeare alludes—

> "Not poppy, nor mandragora,
> Nor all the drowsy syrups of the world,
> Shall ever medicine thee to that sweet sleep
> Which thou ow'dst yesterday;"

and *Solanum esculentum*, Egg Plant, or Dead Sea Apple, which, according to an old tradition, fair as was its outside, contained nothing but "dust and cinders." So Milton says:—

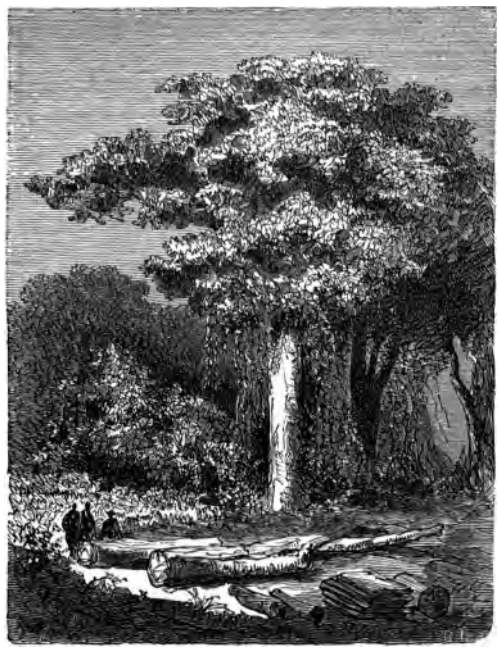
> "They, fondly thinking to allay
> Their appetite with gust, instead of fruit
> Chewed bitter ashes."

To the Solanaceæ, we may add, belongs that highly useful vegetable, already described in these pages, the Potato.

As a prophylactic against fever and ague, and a powerful tonic, *Quina*, *Quinine*, or *Cinchona* bark, deserves our warmest praise. Peruvian, Jesuits' or Cinchona bark, is prepared from various species of *Cinchona*, a tree which grows abundantly on the slopes of the Peruvian and Columbian Andes, from 1200 to 10,000 feet above the sea-level. It is an evergreen, with round trunk and branches; wood, when young, nearly white, turning in time to a pale yellow; flowers white, rose, or purple, exhaling a faint but agreeable fragrance.

The discovery of this important febrifuge is sometimes attributed to the Jesuit missionaries in Peru; sometimes to travellers who had remarked that certain wild beasts, tormented by fever, were impelled through the workings of their instinct to chew the bark of the Cinchona; and according to another tradition, it was the Countess Cinchon, wife of the Spanish viceroy of Peru, who, having been cured by a native of a dangerous fever, imported into

Spain the remedy she had found so beneficial. Owing to the indefatigable exertions of Mr. Clement Markham, and



THE PERUVIAN BARK TREE (*Cinchona*).

other benefactors of humanity, this valuable tree has been successfully naturalized in Java, the Himalayas, the south of Hindustan, and the island of Réunion.

There are probably very few plants not endowed with medicinal properties, and to enumerate even the more important would require a far greater amount of space than remains at our disposal. Castor-oil, senna, rhubarb, assa-

fœtida, ipecacuanha, balsam of Tolu, cochlearia, camphor, ginger, jalap, nux vomica, digitalis (or fox-glove), camomile, catechu, valerian, wormwood, tansy, coltsfoot, gentian, aloes, cascarilla, saffron, lobelia, dandelion—are some of the remedies which our chemists borrow from the Vegetable World.

The usefulness of plants we have to consider from yet another point of view. Few substances or materials have exercised so important an influence on the fortunes of nations as the downy covering of the seeds of the *Gossypium*, which, rightly named "King Cotton," keeps in motion the busy looms of Lancashire, and stimulates the labour-resources of America and India. There are various species of *Gossypium*. *Gossypium barbadense* yields the best cotton, known commercially as "Sea Island," "New Orleans," and "Georgian cotton." South American cotton is obtained from *Gossypium peruvianum;* common Indian from *Gossypium herbaceum.*

THE COTTON-PLANT (*Gossypium*).

The cotton-plant belongs to the order *Malvaceæ* (or Mallows), all whose members are wholesome, and yield

considerable quantities of mucilage; some are valuable for medicinal purposes, others supply materials for cordage. This is specially the case with the fibres of the *Hibiscus* and the *Paritium tiliaceum*.

Some species of *Sterculiaceæ* are useful for clothing purposes. The silky hairs enclosing the seeds of the Silk-cotton tree (*Bombax Ceiba*) have been woven into a tenacious and durable stuff. An excellent material is manufactured from Manilla hemp (*Musa textilis*), and converted in India into the most airy and delicate muslins.

GATHERING COTTON.

Common hemp, not less valuable in a coarser way, is from a totally different plant—the *Cannabis sativa*, a member of the great Nettle family, or *Urticaceæ*. Several species of nettles furnish fibres fit for textile purposes; the Chinese silky cloth is woven from those of *Bœhmeria nevia;* and *Bœhmeria Puya* yields the Pooah or Puya stuff of Sikkim and Nepaul.

In the West Indies the fibrous leaves of the *Bromelia Karatu* are employed in making cordage and hammocks. New Zealand Flax (*Phormium tenax*) supplies the basis of various kinds of stuff; and textile fibres are also furnished by several species of Palms. Jute is the fibres of the bark of the *Corchorus olitorius*. Even paper is manufactured from vegetable substances, though the papyrus reed has long since fallen into disrepute. Flax, hemp, and cotton, and some of the grains, are the staple of our paper-mills.

It is impossible to indicate the numerous plants that are available for the painter and the dyer. The value of indigo as a blue dye is known to every school-boy. It is obtained from various species of *Indigofera*—a member of the Leguminosa family. The same family includes the *Pterocarpus santalinus*, or red sandal-wood; and *Hæmatoxylon campeachinum*, or logwood. Fustic is the produce of *Maclura tinctoria*. Dyers also use, for yellow tints, the acorns of the Valonia oak (*Quercus Ægilops*), and *Quercitron*, the bark of *Quercus tinctoria*.

Lastly, the Vegetable World supplies the builder and the cabinet-maker with a rich abundance of different kinds of timber. It is true that these differ greatly in value, from mahogany to deal, and cedar to ironwood, and that they are not all capable of the same mode of application; but that each variety has its uses, the most careless reader will admit. Some are best fitted for tropical climates, others for temperate; some are remarkable for their durability, others for their high polish; some are tough, resist-

ent, and impenetrable; others are flexible, and easily wrought by the workman's hand. Here, as in all Nature, we are surprised by the infinity of our resources. We are not limited to any single kind; every taste may be gratified. We may turn from the cypress to the elm, from the yew to the larch, from the walnut to the sycamore. We may decorate our ceilings with odoriferous cedar, and line our floors with polished oak. Nor need we apprehend any failure in the supply, for the grand work of *restoration* has succeeded to that of *creation*, and still the seed ripens into the young plant, and the plant develops into the sapling, and the sapling matures into the tree.

"Fresh groves grow up, and their green branches shoot
Towards the old and still enduring skies,
While the low violet thriveth at their root."*

* Henry Vaughan.

VIII.—ON THE FORESIGHT AND MUTUAL RELATIONS OF PLANTS.

"Whom what he finds
Of flavour or of scent, in fruit or flower,
Or what he views of beautiful or grand
In nature, ...
Prompts with remembrance of a present God."

COWPER

PRUDENCE, says La Fontaine, is the mother of safety; an axiom which may be compared, or paralleled, with Shakspeare's: "To fear the worst oft cures the worst." A practical commentary on both these "wise saws" is afforded by the Plant, which displays throughout its changeful existence what may almost be called an admirable sagacity. Unlike too many of our own kind, it invariably makes provision for the support of its offspring, nor abandons them to their own resources until assured they are strong enough to maintain themselves.

We find in the Vegetable World the types of the various classes of humanity; some are weak and poor, others are strong and rich. There are the patricians of the forest, as well as the plebeians of the underwood; gay and laughing beauties, whose existence seems one long sunshine, and

lowly maidens "in russet clad," who shrink modestly into the shadow, and weave and spin with laudable perseverance. But in all these classes we meet with the same tenderness on the part of the parent towards its progeny.

Will the reader take fright at the Latin quotation from Linné?—"Gramina plebeii, rustici, pauperes, calmacæi; vulgatissimi, simplicissimi, vivacissimi; regni vegetabilis vim et robur constituentis, quoque magis mulctati et calcati, magis multiplicativi."

If he be fresh from his Virgil or his Cicero he will easily translate the words of the great Swedish botanist, but as such may not be the case with all who glance at these pages, I subjoin an English rendering:—

The Gramineæ, or grasses, are the plebeians, the rustics, the paupers, and the peasants of the vegetable world; they are its simplest, commonest, and most vivacious members; they possess all its force and strength; the more we maltreat them and tread them under foot, the more they multiply.

Of the oak, the distinguishing quality is strength; of the rose, elegance; of the violet, perfume; but the grasses have neither strength, elegance, nor perfume. The favourites of our gardens are entrusted to the earth in warm spring days—are fostered, and watered, and lovingly tended; the grasses are flung forth upon the soil just before the coming of the snow-king, and called upon to endure all the rigour of the winter. Their tiny blades scarcely peep above the surface before the husbandman smites them down with his inexorable plough, or remorselessly passes over them a heavy roller which would crush the more delicate children of our "scented bowers." But the

young green shoot, all full of life, profits by its very humiliation; like Antæus, the son of Earth, it derives fresh vigour from each new contact with the soil, and develops those adventitious roots which assure its solidity, its nourishment, and the multiplication of its offshoots.

Our cultivated grasses, such as wheat and barley, hasten to grow tall on the first approach of genial summer; they absorb the silica from the surrounding earth—absorb it into their tissues—and shape their stem into the solidest form and structure possible with the small quantity of matter at their disposal; they flower as early as the months of May and June, and develop a numerous posterity. Their life has been so vexed and harassed, that no time has been given them for the acquisition of a patrimony for their descendants; but, from the moment of fertility, their energy redoubles, and they amass around their embryo offspring an abundant, a solid, and a durable nourishment. As soon as this provision is collected, the active existence of the wheat, the barley, and the rye is terminated; they pass away, and their places are occupied by their descendants.

Only a small number of these descendants will be developed in their turn, for man who collects them returns but a few to the earth. Absolute master of their destiny, he strips the others of their inheritance, robs them of the *farina* which the prudent parents had gathered up for their children, and converts it into bread. He does not even disdain to make use of the ovary, or seed-vessel, which has encased itself in a hard shell for the protection of the embryo and its supply of food; he employs it under the name of *bran* for medical purposes, or for the nourishment of his domestic animals.

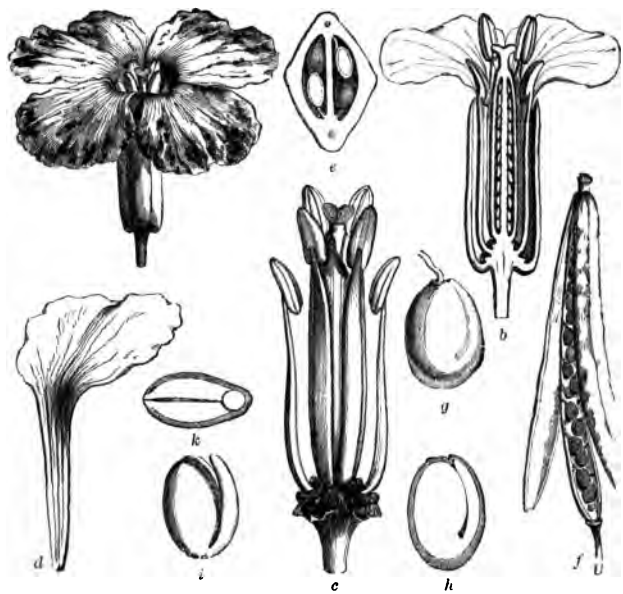
In all this wonderful forecasting of the future, this adaptation of means to end, do you not see the wisdom of the Creator most vividly displayed? Is it possible to believe

VARIOUS PARTS OF THE MILLET.

- *a*, The branch, or shoot, bearing the leaves and flower-buds.
- *b*, One of the flowers.
- *c*, Vertical and medial section of the flower.
- *d*, Stamen (back and front).
- *e*, Pistil, with its three stigmatic extremities.
- *f*, Fruit surrounded at the base by a simple calyx.
- *g*, Vertical section of fruit to show the seed.
- *h*, Horizontal section of fruit, of the seed contained in it, and of the embryo.
- *i*, The embryo.

that mere chance, or any arbitrary scientific law, could have bestowed on the grass this power of anticipating and providing for the necessities of its offspring? Is it not a direct and undeniable testimony to the existence of a supreme Power? But, in truth, the Divine Hand is as plainly visible in the young green blade, in the flower and fruit of the millet, or the clove, in the down-trodden herb, in the lichen and moss which shed the beauty of colour about the barren rock, as in the oak and the pine, or the lightning and the thunder. In the very structure of the grass you may trace the active exercise of the highest wisdom. Observe the fibrous and tenacious character of the root, and its extraordinary vitality; so that, as already observed, the more it is hacked and bruised the faster it spreads and the stronger it grows. Observe, too, its power of extension, each joint sending up a new shoot, so that it rapidly overruns a considerable area, and covers the soil with a luxuriant vegetation which assumes the appearance of a beautiful carpet. Observe, moreover, that as its blossoms are often prevented from expanding, through the destructive agency of animals or human implements, it has been endowed with the property of propagating itself by its budding roots. Mr. Macmillan remarks that its hollow and knotted stem or culm, with its thin covering of flint, has been so constructed as to combine the utmost strength with elegance and lightness of form; and that such is the effectiveness of these mechanical appliances, it will successfully resist the most violent winds, unless previously beaten down and enfeebled by heavy rains. The leaves, he adds, exhibit an equally remarkable adaptation to circumstances. They are spear-shaped, and strongly ribbed with threads

of flinty fibre, thus forming wedges admirably fitted for forcing their way through the soil with the least resistance; they are long, narrow, and alternate, and sheath the stem for a considerable distance, in order to present the narrowest possible surface and the lightest possible



VARIOUS PARTS OF THE CLOVE.

a, Flower of the clove or pink.
b, Vertical and middle section of the flower.
c, Flower reduced to its male and female portions; the stamens are six in number—four large (in pairs), and two small.
d, One of the petals.
e, Horizontal section of the ovary, or seed vessel, showing the insertion of the ovales.
f, Fruit at the moment of expansion.
g, Seed, with its funiculus.
h, Vertical section of the seed and its embryonic contents.
i, The embryo alone.
k, Horizontal section of the seed and its embryonic contents.

hold to the winds; they have no branches, that they may grow together in masses without suffering from deficiency of air or light. And, to conclude this digression, the flower is an equally marvellous instance of the most careful prescience and design. It is produced from the upper sheath, which altogether encloses it when young; it is disposed in simple or branching heads, each consisting of two or more chaffy scales, inserted the one above the other, like the plates of a steel cuirass. Each scale is ornamented with three white slender threads, which, crowned with yellow dusty knobs, play freely about in every breeze. These threads are the stamens of the flower, and in the cereal grasses of the most vital importance, for without them the ears of corn would not be filled with the nutritious grain.

It should be remembered that there are upwards of three hundred genera and more than five thousand different species of grass. Yet, though the varieties are so numerous, the typical or fundamental character is singularly marked in all; the whole appearance, the general air, the mode of growth, the peculiarities of structure, are in each species so similar, that no class of plants can be so easily identified.

The careful attention to the wants of the future plant so remarkable in the grasses is scarcely less notable in the other members of the vegetable kingdom. The nourishment which they accumulate consists of albuminous, feculent, saccharine, or oleaginous principles,* either aromatized or not. Sometimes the food is deposited in the

* Albuminous, feculent, saccharine, oleaginous—hard words these for our younger readers!

kind of pouch, or *sac*, wherein the development of the embryo takes place; or without the sac, in the ovale, in which case it is called *albumen;* sometimes it is stored up in the primary leaves, or *cotyledons*. Whatever its position, man knows where to find it, to rifle it from its natural possessor, and turn the theft to his own advantage.

For instance, the cotyledons of the haricot, the pea, the bean, and the lentil, furnish an azotised nourishment scarcely inferior to meat. The pea, for example, contains a large quantity of *casein*—an element very efficacious in forming flesh, and identical with the casein, or nourishing principle of cheese. The following is an analysis of one hundred parts of pea-meal:—

Water,	14.1	Fat,	2.0
Casein,	23.4	Woody fibre,	10.0
Starch,	37.0	Mineral matter,	2.5
Sugar,	2.0		
Gum,	9.0		100.0

The cotyledons of the embryos of the almond, the filbert, the turnip-cabbage, the radish-cabbage, rape, white mustard (*Sinapis alba*), black mustard (*Sinapis nigra*), sesamum, pistachio, cameline, beech-nut, hemp, walnut, yield various kinds of oil, either for edible or industrial purposes.

The cotyledons of the embryos of the melon, pumpkin, and cucumber are medicinally useful. Those of the Tonka bean (which is the fruit of the odorous Coumarouna of Guiana) are employed in perfuming tobaccos; those of the Calabar bean (*Physostigma venenena*) contain a poisonous principle, and are employed in therapeutics.

The entire seed, and particularly the albumen, of the flax plant, the carnation, the horned poppy, the castor-oil plant, the croton, and the spurge, furnishes an oil capable

CASTOR-OIL PLANT (*Ricinus communis*).

of divers applications. The same parts of the cacao-nut yield the "butter" of cocoa and chocolate. The corneous albumen enveloping the embryo of the coffee-tree contains the principles which render coffee so stimulating and invigorating a beverage; that which surrounds the embryo in the seeds of nux vomica and St. Ignatius' bean embodies, among other principles, the very formidable poison known as strychnine. The albumen in the seeds of the stramonium, or thorn-apple, has narcotic properties; that of the seeds of the nutmeg and pep-

per-plant possesses stimulating qualities, which constitute their value as condiments or spices.

Other plants, as we have already said, display so great a prudence that they do not flower until they have accumulated their food-supplies. Thus, the turnip and the carrot pass the first year of their existence in accumulating in their root a great quantity of sustenance; meanwhile the stem enlarges slowly, but during the second year it turns its resources to account; they pass into the stem, which elongates rapidly, and develops in abundance both flowers and fruit. Who has not remarked that, during the second year, the root grows empty as the stem rises, and that, after the fructification, it is dried up and wrinkled?

THE TURNIP (*Brassica Rapa*).

The storehouse of abundance is not always placed in the same organ, but man and the animals know where to discover it at need.

In the salsafy and the radish the treasury of nourishment is found in the root, but in the Brussels cabbage in the bourgeons or buds; in the headed cabbage, or cabus, you must seek it in the leaves; in the cauliflower it lies in the inflorescence. And

hence man eats, with impartial taste, the roots of the salsafy and the radish, the buds or sprouts of the Brussels cabbage, the leaves of the headed cabbage, and the white inflorescences of the cauliflower. Who does not know that when the cabbages, and radishes, and salads run to seed, they contain but few nutritive principles in their comestible portions, and are no longer fit for human food!

THE CARROT (*Daucus Carota*).

In the Manihot (*Manihot utilissima*), a plant which grows very extensively in South America, the provision is made in the root. The root, which is excessively voluminous, containing, in addition to a poisonous substance, got rid of by the agency of fire, and said to be hydrocyanic acid, a valuable *farina*, the very foundation and staple of the food of the Brazilians. This is the famous Cassava bread. There are two varieties of the Manihot or Manioc-plant — one sometimes called *Janipha Lœflingii*, having a spindle-shaped root, brown externally, and about six inches in height, which is used for food under the name of Sweet Cassava; the other, known as Bitter Cassava, having a black and knotty root, sometimes weighing as much as thirty pounds, which is bitter and poisonous, but

after it has been thoroughly rasped, and washed, and granulated on hot plates, yields the much-esteemed tapioca.

THE MANIHOT (*Manihot utilissima*).

The pith, or cellular tissue, occupying the centre of the stem, frequently serves, like the other parts of the plant, for a magazine. This is the case with several species of palms; as in the Sago Palm, which supplies us with the sago of the Philippines; and in the Areca of India and the Indian archipelago, to which we are indebted for the sago of Borneo.

It would be easy to multiply these examples; but I fear to weary the attention of my readers, and, moreover, it is to be hoped enough has already been said to stimulate and encourage their own independent researches. Let them examine such plants as the thistle, the artichoke, the asparagus, and ascertain what portions—flowers, fruits, and seeds excepted—are useful in the way of food.

The moment we recognize a single type among or-

ganized beings, we cannot fail to admire the variety of forms under which it is represented. Thus, we have seen the storerooms of plants disposed in numerous places, and with different contents; we may also find them either single or multiple for each plant, destroyed with the plant, or displaced, according to the necessities of vegetation.

JAPANESE YAM (*Dioscorea sativa*).

The radish provides a solitary deposit of nutriment, flourishes, fructifies, exhausts its provision, and dies in one and the same year. The beet-root in the first year lays up its supplies; then in the second it flowers, fructifies, exhausts its provision, and perishes. The American agave amasses its stores for ten, twenty, thirty, fifty, and a hundred years; it garners them up in its leaves, and then at the prescribed epoch rapidly puts forth its stem, flowers, fructifies, exhausts its reserve, and withers. Our

*monocarpic** plants act in this fashion, and die at the birth of their descendants.

It is different with our trees, as well as with many herbs or shrubs, which are *polycarpic*. They flower every year, every year they levy a contribution on their deposits, but every year they also renew the supplies. It is in the summer, or at the close of that season, that the outlay attains its maximum among the majority of our European plants, because it is at that epoch the embryo is born; it is at that epoch they must deposit near the child the sustenance for its future wants; it is then that, despite its fatigued condition, the tree seems to double its energy; it profits, so to speak, by the vigour of August, and re-establishes for its next progeny the fortune it has bestowed on those about to take leave of it; it commences laying up larger supplies in the "arm-pit" (*axil*)† of the leaves, in every place where next year the branches or flowers will make their appearance. Every reader may examine for himself the existence of those stores or depôts of food. They form more or less elevated bosses, whose interior contains a large proportion of fecula. In fine weather the tree develops so much energy, toils so swiftly, becomes so rich, accumulates such immense supplies, that the buds and shoots of the following year draw upon the deposit, and anticipate their proper season; they expand themselves, and put forward their leaves or flowers. This is called *autumn flowering*, or *foliation*.

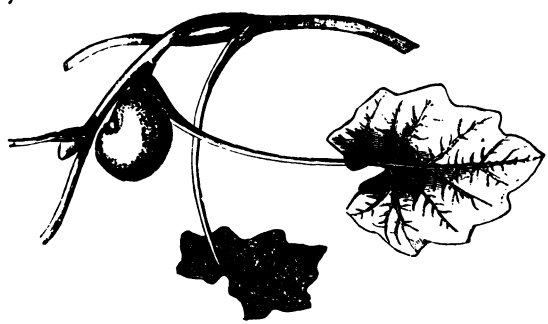
In some plants the seeds develop themselves with difficulty, or are not very well adapted for reproduction; these

* From μόνος, one; and καρπὸς, fruit;— plants which flower once only, and then die.

† This is the angle formed by the junction of the leaf with the stem.

plants amass their supplies of nourishment for other suckers, and these suckers are shoots or branches, which, sometimes alone, and sometimes concurrently with the seeds, will reproduce the plant.

In the *Ranunculus Ficaria*, or Lesser Celandine, the stores are deposited in a small bourgeon, shaped like a ball, which shows itself at the axil of certain leaves. At



BRANCH OF RANUNCULUS FICARIA, WITH TINY BULB.

a given epoch, this tiny swelling, or miniature bulb, loosens itself from the mother-plant, falls upon the ground, and there attaches itself with adventitious roots to constitute a distinct individual.

Some species of the genus Garlic develop these *bulblets*, whose young leaves are gorged with food in the very bosom of their inflorescence. They detach themselves, and spring up into independent plants, like those of the Lesser Celandine.

In the aquatic Aldrovandus, the buds which terminate the branches satiate themselves with nutriment, drop to the bottom of the water, and in spring return to the surface for the purpose of reproducing the plant.

In the tulips, lilies, and hyacinths, a great store of nourishment is yearly deposited in certain leaves of an auxiliary bourgeon or offshoot, which, at a later period, shoots erect and bears the flower. In the dahlia the aliment is accumulated, at the end of every season, in the different portions of a fasciculated root.

The phenomenon most worthy of remark takes place in the vegetation of the potato. This singular plant possesses two kinds of branches: those of the one kind are aerial, elongated, and capable of flowering; those of the other, subterranean, bulging, not green, and at the first glance might easily be mistaken for roots. It is the latter which reproduce the plant, and they contain an abundant provision of fecula. On the surface of each are conspicuous a certain number of very little buds or shoots, situated in the depressions or eyes, at the axil of the little scales which represent leaves.

Place one of these tubercles in the earth, and you practise in reality the operation of "budding;" the young shoots imbibe from the common reservoir the nourishment necessary for their development, until the adventitious roots develop themselves, and derive from the soil their proportion of aliment. A potato sometimes develops as many branches as it has buds or suckers, so that you may divide it, and put in the earth fragments with only two or three eyes, if you want only two or three roots. But you must beware of imitating the ignorant and avaricious husbandman, who, in his anxiety to multiply the portions of potatoes for planting, cut the tubercle at hap-hazard without any regard to the buds; for it may be asserted that every portion without eye or bud, if put in the ground,

does not develop a branch. There is no need to touch the tubercles if you only want to develop their suckers; this development often takes place in the spring, in cellars where potatoes are stored up, in which case the supply of fecula undergoes transformation and proceeds towards the new shoots. It is not astonishing, therefore, that old

THE POTATO (*Solanum tuberosum*),
In full vegetation, showing both its aerial and underground branches.

potatoes, eaten at the end of winter or at the beginning of spring, should be less rich in fecula, less good than those which are consumed earlier in the year. The vendors of this valuable article of food are not ignorant of this peculiarity, and are, consequently, very careful to disguise the budding by exposing for sale only those whose young branches have been broken off. It is easy to avoid being

deceived by this "tradesman's trick," because you may readily ascertain the absence of the bud or breakage of the branch; moreover, the withered look of the tubercle is a sign that a portion of its contents has escaped.

So much, O reader! have I thought it advisable to say on the subject of the prevision, forethought, or sagacity of plants. It would be easy to multiply facts and accumulate observations, but, leaving the student to pursue his researches independently, I turn to a brief consideration of what may be called their *inner* lives, the modes of existence they follow, either singly or in connection with one another.

Some plants live the life of lonely anchorites; they are never found in company, but always at considerable distances apart. This melancholy solitude is apparently congenial to the graceful moss known as the leafless *Baxbaumia;* which vegetates concealed among the undergrowth, as if to hide from the intrusive gaze its elegant arm. Other plants are equally fond of society; they gather together in great communities, where like meets like, and few strangers are admitted; such are the heaths, some of the mosses, some of the grasses, and certain algæ. Others, again, are less exclusive, and unite in mixed groups; and not a few may be looked upon as the "bores" of the vegetable world, who intrude themselves into company for which they are not fitted, and where they are not welcome.

Among all these plants, those which live in communities possess the most importance; they give character to the landscape, they exercise a favourable or unfavourable influence on the climate, they modify the character of the soil, they prepare the development of other vegetables,

and frequently become for man a source of abundant wealth.

The forests of pines and firs permit no herbaceous plants in their vicinity; they prevent the seeds from germinating, and if, peradventure, the germination has taken place, the young plants, deprived of light, are choked under the débris of bark and foliage.

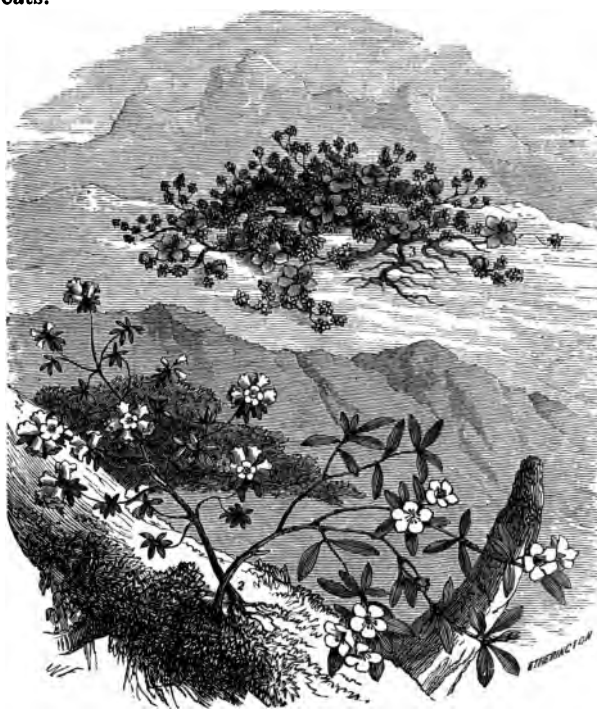
The pines are ever companionless; the great shade flung by their leaves prevents the normal development of the plants which struggle in vain against its overwhelming influence.

Of several seeds sown at the same time, and belonging to different species, those whose roots develop the most quickly gain the widest expansion, and reduce the others to a scarcity which kills them.

Every day horticulturists remark that when they plant a mass of rhododendrons or azaleas on a heath, near a fresh green hedge or vivacious shrub, these rhododendrons and azaleas—glorious as they are in a suitable habitat—assume a sad and sickly aspect, indicative of want of nourishment. In truth, the pushing, living roots of the hedge, in their greedy and thievish appetite, stretch far into the purple heather, plunge deep into the soil, and seize upon the sustenance needed by their neighbours. It has been observed of thorn-bushes separated from a kitchen-garden by a ditch, that they have thrust their roots right into the midst of the vegetables, appropriated the mould intended for their support, and consequently prevented their proper growth.

Every farmer knows that when the scabious obtains a footing in a field of flax, a circle of barrenness is formed

all around it. The effect of the darnel in a field of corn is equally malignant; and that of the crisium among oats.



RHODODENDRONS OF THE HIMALAYA.

1. R. Pendulum. 2. R. Dalhousie. 3. R. Nivale.

If, however, certain plants seem to entertain a mutual hatred, there are many which apparently nourish a very genuine and earnest sympathy. Certain kinds of mushroom, as the *morell*, are always found at the feet of the elm

and the ash; the *salicaria*, or smoked willow-herb, as its name implies, in the neighbourhood of willows.

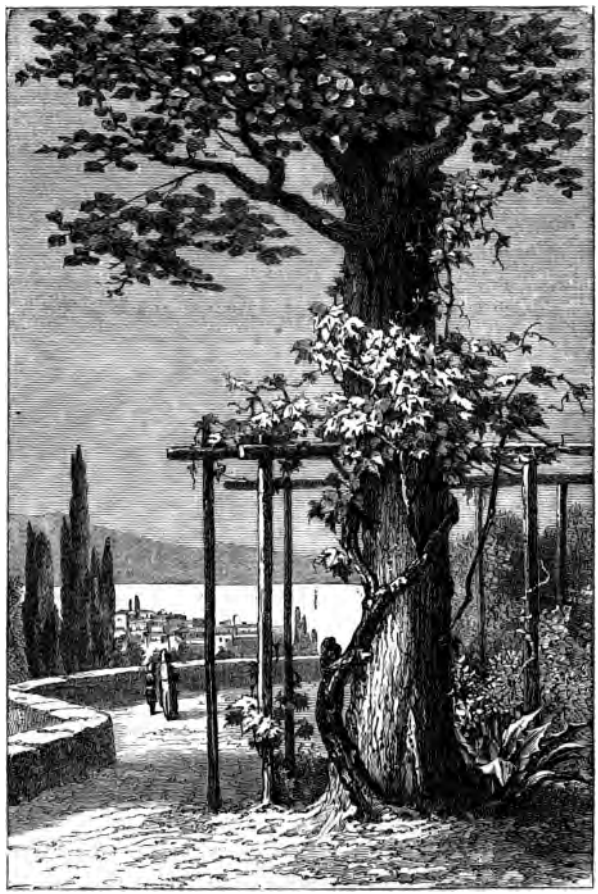
Others, too weak to rise in the world without the assistance of the strong, support themselves upon their trunks and branches, and by this means succeed in gaining the highest points. In Italy the vine enfolds itself around the elm, now coyly shrinking from it, now clinging closer and yet closer, and describing, in its capricious movements, the most graceful but fantastic undulations. Hence the allusion of Shakspeare:—

> "The female ivy so
> Enrings the barky fingers of the elm;"

while Milton describes how the first gardener

> "Led the vine
> To wed her elm; she spoused, about him twines
> Her marriageable arms."

Everybody knows how the "lush woodbine" and the fragrant honeysuckle smiling spread themselves about the green hedgerows, or creep up the cottage wall and the old manorial gable, glorifying them with the bloom of beauty, and filling the air with honied sweetness. The nasturtium and the canariensis, with their bright gay flowers, likewise show themselves to be in need of a "helping hand." So, too, the convolvulus, with its delicate pink and trumpet-shaped blossoms, winds among the tenacious stems of the privet hedge, or with slender tendrils clasps the bole of the rugged oak. But there is almost a world of creeping and climbing plants which are unable to flourish without prop or stay, and some of which are invariably found in connection with a particular tree, or affecting a special situation.



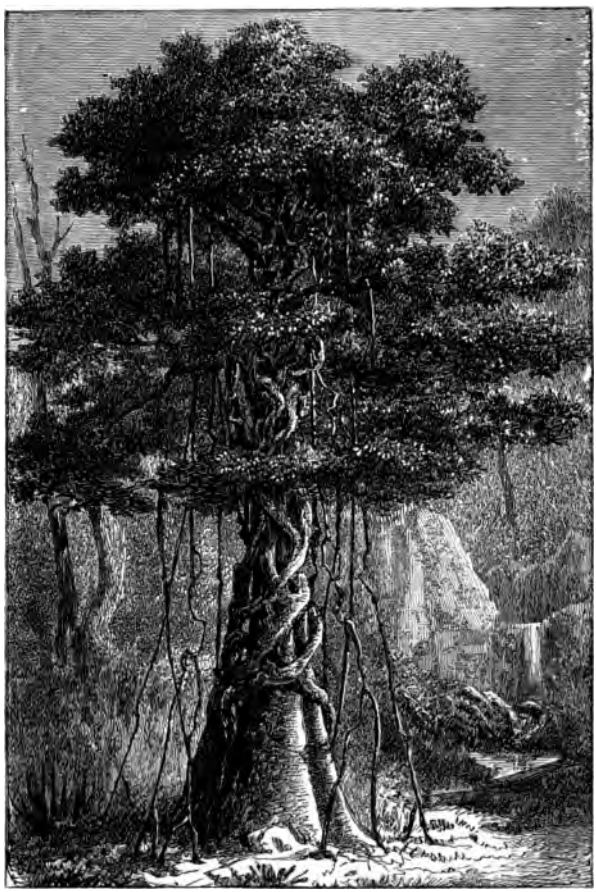
VINE AND ELM.

Frequently this sympathizing disposition tends to the irretrievable injury of the plant which calls it forth. The

elm is often choked by the close embraces of the ivy. The tropical *lianas*, or creepers, almost invariably kill the trees around whose once sturdy trunks they have entwisted their own vigorous and aggressive life, and develop in such luxuriance as to render the forest actually impassable. Here is a traveller's picture:—"The leafy crowns of the trees, scarcely two of which could be seen together of the same kind, were far away above us, in another world as it were. We could only see at times, where there was a break above, the tracery of the foliage against the clear blue sky. Below, the tree trunks were everywhere linked together by sipós; the woody, flexible stems of climbing and creeping trees, whose foliage soared far away above, mingled with that of the taller independent trees. Some were twisted in strands like cables, others had thick stems contorted in every variety of shape, entwining, snake-like, round the tree-trunks, or forming gigantic loops and coils among the larger branches; others, again, were of zigzag shape, or indented like the steps of a staircase, sweeping from the ground to a giddy height."

The deadly influence exercised by these parasites of the American forest finds a vivid illustration in the pages of Burmeister.

In the Brazilian wilderness, he tells us, is often to be seen a singularly impressive phenomenon—a couple of trees, equally strong and robust, and several feet in girth; the one, majestic in aspect and of an uniform rotundity, resting upon a foundation of solid roots extended over a considerable area and shooting perpendicularly upwards to an elevation of 80 or 100 feet; the other, with swelling sides, and hollow for half its stature, leaning against the



TREE ENCIRCLED BY LIANAS.

former, and balancing itself at a great height above the ground on roots of the extremest slenderness, with branches,

rafter-shaped, that seem hardly able to support it. As if afraid of falling, it suspends its burden on its neighbour, fixing itself with divers hooks at various points of elevation. Hooks, we have said, but more correctly speaking, rings; for their extremities are not only brought into juxtaposition, but *fused* and *soldered* together. They grow apart until they attain an equal height, then, closing round the other trunk until they meet together, they destroy the bark by the progressive pressure of the two extremities, and finally effect a complete junction. For a lengthened period the two trees will stand side by side in luxuriant vigour, interweaving their crests and differently-coloured foliage in such intimate communion that it becomes impossible to separate them. At length the fierce compression of the older tree, by its parasitical friend, grows so intense that the ring or tendril, incapable of further expansion, prevents the free circulation of its sap, its life-blood, and the trunk withers up, the victim of a perfidious foe, which had approached it with every pretext of amity and feebleness! It lowers its crest; one by one its branches fall to the ground, and the murderous liana gradually replaces them by its own, until the last has disappeared. Behold them now! The living parasite clinging to the dead tree, and clasping it in an inextricable embrace! A pathetic sight, it is true, so long as you are unaware that the survivor, under the guise of hypocritical friendship, has strangled the dead giant reclining in its arms for the purpose of more tranquilly absorbing its vigour. But *it* too, in its turn, will meet with the doom it merits—the slain tree toppling to the ground will bring down with it the false liana, which, seeking vainly the support of some other

trunk, shall wallow unpitied in the black mire of the impenetrable forest.

The fairest flowers ever created by Nature's partial hand —those which exhibit the greatest richness and the utmost variety of composition; whose colours are the most brilliant, the most skilfully arranged and blended; in a word, those of the Orchids—are the outcome of plants nourished, very frequently, on nothing but vegetable refuse. In Mexico and the Sunda Islands, where the most gorgeous members of this family exist, the hoary trees are clad with hundreds of them; some characterized by an upright stem, others pendulous and shrinking, many epiphytous, and not a few terrestrial; others, again, with large expanded root, instead of stem, out of which escape rare clusters of the most lovely blossoms. The old and decayed tree, in these cases, simply serves as a prop or framework, for it is unable to supply any real nourishment to the graceful plant which has selected it for its abode; the latter generally puts forth a number of adventitious roots, and these, from the substances existing in the atmosphere, seem to derive the scanty nourishment they stand in need of. Some idea of the physiognomy of a country where these strange plants abound may be gained by a visit to a conservatory of orchids; on all sides droop the trunks of trees, garnished with the delicate flowers, whose adventitious roots descend to imbibe from an artificial atmosphere the warm moisture so essential to their development.

Lichens and Mosses love to find "a local habitation" on the bark of fruit-trees; but it is probable they do not live parasitically, inasmuch as they flourish with equal

ORCHIDS (*Orchidaceæ*).

vigour on the rugged surface of a rocky cliff or of a wall of solid stone. Some species, however, are exclusively restricted to the trunks and boughs of trees, which they adorn with "lucid sprays of emerald dye." Others change their colour according to their habitat; as, for instance, the *Neckera crispa*, which, when it clothes a tree, wears a deep, dark, and sombre green, but becomes a bright yellowish-green when it grows and creeps over lichen-clad rocks. The cord-moss (*Funaria hygrometrica*) flourishes only in woods where a conflagration has taken place.

Some of the lycopods, or club-mosses, so abundant in New Zealand, affect the tree-ferns, and enrich their trunks with long trailing, glossy wreaths.

It is not alone the massive trunk, and spreading branch, and clustering foliage which make up the beauty of the woods, but the graceful climbers and creepers, the emerald moss and the trailing lichen.

THE BEARD-MOSS.

One species of Lichen, a very beautiful species, of a bright yellow colour, is found attached in large clusters to the bark of oaks and firs. On the birch, the beech, and the hazel grows a still more curious kind, the *Opegrapha*, or "written lichen," so called from its quaint resemblance to the written language of man. Its fructification consists of long wavy black lines, which are sometimes parallel, like Runic inscriptions, sometimes clustered and grouped together, like Arabic and Chinese letters, and sometimes arrow-headed in shape, like the cuneiform characters of Assyria. Messrs. Huc and Gabet, in their "Travels in Tartary, Thibet, and China," in-

clude a very interesting description of a phenomenon called the "Tree of Ten Thousand Images," near the town of Koumboum, in Thibet, which evidently owes its marvellous features to the handiwork of this lichen.

On our eyes, they say, being directed with earnest curiosity to the leaves, we were overcome with an absolute terror of astonishment at finding upon each of them well-formed Thibetan characters, all of a green colour, and some darker, some lighter than the tree itself. Our first impression was a suspicion of fraud on the part of the lamas; but after a close investigation of every detail we were unable to discover the slightest deception. The characters all appeared to us parts of the leaf itself, and as much so as its veins and nerves; in all the position was not identical —in one leaf they were found at the top, in another in the centre, in a third at the base on the side, while in the younger leaves they existed only in a partial state of formation. The bark of the tree, and its branches, which resemble that of the plane tree, are also covered with these characters. Remove a fragment of the old bark, and the young bark beneath it will show you the indistinct outlines of characters in a condition of germination; and what is curious exceedingly, these new characters are sometimes different from those they are intended to replace. We investigated everything with the closest scrutiny, in order to detect some indication of fraud, but none was visible; and our faces actually streamed with sweat under the influence of the emotions excited by this mysterious spectacle.

Had the travellers been acquainted with the "written lichen," however, their emotions would scarcely have been so overpowering. It was doubtlessly with the characters

of this curious plant that the hand of Nature had inscribed the bark and leaves of the Tree of Ten Thousand Images.

Lichens spread in great profusion over the bare rock, the stone wall, the exposed cliff, the rugged hill-side; they will grow anywhere, and under any sky, if they can but secure some suitable support. You will find them clothing the trees of tropical forests, except in Brazil, where their place is occupied by the orchids and lianas, to which I have already alluded; on the bones of animals that have perished in the deserts of Sahara and the Great Gobi; on the low walls of an English garden; as far north as Melville Island,* as far south as Deception Island;† on the icy plains of Lapland, and the snow-crowned summits of the Himalayas. It is their mission, apparently, to prepare the way for higher forms of vegetation. They spread "their powdery crests and little coloured cups" over the naked rock, crumble its surface into sand, and with this sand and their own decaying substance form a thin layer of mould fit for the reception of the humbler mosses. These, in their turn, repeat the process, and increase the depth of soil; mosses of a higher order take root, and flourish, and die, contributing in their death to the life of some vigorous flower; and so the operation continues until the desolate rock is mantled with glorious sward, and enriched with a crown of noble trees.

> "Seeds, to our eye invisible, can find
> On the rude rock the bed that fits their kind;
> There in the rugged rock they safely dwell,
> Till showers and snows the subtle atoms swell,
> And spread th' enduring foliage; then we trace
> The freckled flower upon the flinty base;

* The species called *Lecidea geographica*. † The species called *Usnea fasciata*.

> These all increase, till in unnoticed years
> The sterile rock as gray with age appears,
> With coats of vegetation thinly spread,
> Coat above coat, the living on the dead;
> These then dissolve to dust, and make a way
> For golden foliage nursed by their decay."

All the plants of which we have hitherto been speaking, whether epiphytous or clinging to the soil, secure their own food—are, in fact, independent purveyors. But this is not the case with the true parasites, which select a plant, are born and live and are developed on its substance, generally dying with it. Some, like the Orobanches, or Broom-rapes, attach themselves to the roots of different plants, and hence are called root-parasites. Different species infest and destroy divers tribes of plants.

Thus: the *Orobanche rapum* feeds upon broom and furze; the *O. ramosa*, upon hemp; *O. rubra*, upon common thyme; *O. minor*, upon red clover; *O. barbata*, upon the ivy; *O. elatior* and *O. arenaria*, upon various species of Compositæ, as centaury and milfoil. The Scale-wort (*Lathræa squamaria*) grows parasitically on the roots of hazels, cherry-laurels, and other trees, extracting from them the nourishment which *they* have extracted from the soil. As a rule, these plants wear a sombre tint, and are never truly green; they present the remarkable peculiarity, as already indicated, that each species generally lives on the same species of plants; one on thyme, another on lucerne, a third on trefoil—never showing themselves inconstant in their dangerous attachments.

The species of *Cuscuta*, or Dodder, are also parasites. Their appearance is that of long filaments, which twine themselves around the branches of other plants, and become attached to them by means of suckers, absorbing for

OROBANCHE LIVING ON THE ROOT OF THE WILD THYME.

their own use the nutritive fluid they contain. They then lose all connection with the soil, and are solely supported by the life-blood of their benefactors. In this way they not infrequently destroy whole crops of lucerne, thyme, clover, and flax. They spread with terrible rapidity, and are almost as much to be dreaded by the husbandman as a flight of locusts. It is useless to provide them with the support of a timber framework or a dead tree, or to place at their disposal any other plant than that which they themselves select; they perish of inanition if they do not obtain their accustomed food.

The Orobanchaceæ and the Cuscuteæ, however, are

humble parasites, and rise but a few feet above the surface of the soil. The Mistletoe is of a more aspiring disposition. It loves to climb up the sturdy trunk of the oak; or, if none such can be met with, falls back upon the apple and pear trees of our orchards. It is carried to the arms of its foster-mother by birds, such as the thrush, the merle, and the missel-thrush; it is then in the condition of fruit deposited by the bill of the bird, and owes to the glutinous matter of this fruit the power of attaching itself to the knotted branch of the tree. Most frequently the fruit is swallowed by the bird, and its seeds, issuing from the temporary prison formed by the digestive tube of the messenger, are deposited on twig and stem, in the midst of substances adapted to favour their development.

DODDER (*Cuscuta*).

However this may be, the seed is not long in germinating. The radicle issues from its envelope, gradually increases in size, penetrates into one of the numerous chinks and crannies of the bark, continues and still con-

tinues its onward movement, and finally lodges between the bark and wood of the sustaining tree. Thenceforth its development is rapid. It becomes one with its foster-parent; derives from it its ready-prepared nourishment, spreads abroad its dichotomous* branches, and its pairs

MISTLETOE FLOURISHING ON APPLE-TREE.

of light green leaves. Every spring it flowers, and afterwards ripens its fruits, which bear some resemblance to tiny pearls.

* Forked: from δίχα, two ways, and τέμνω, to cut.

The species of the mistletoe vary according to the country in which they flourish, and adopt different kinds of plants for their protectors; some bear a reddish-coloured fruit, others a yellow, and others a blue. Not infrequently it spreads over a plantation in such profusion as completely to destroy it; in America its ravages among the coffee plantations are often terrible.

The species so common in England is known by the botanical name of *Viscum album*.

A curious legend concerning this popular plant is found in the old Norse mythology. Balder, the sun-god of the Scandinavians, one day communicated to his mother Friga a dream which he had had, and which portended his speedy death. To avert such a calamity the goddess summoned before her all the powers of nature—air, water, fire, earth, the plants, and the animals—and made them swear that they would do her son no hurt. She then considered him as safe as Thetis thought Achilles, after dipping him in the waters of Lethe; and Balder went to take his part in the great battles of the gods, fighting fearlessly in the midst of a storm of arrows.

Loke, his chief enemy, however, discovered the secret of his invulnerability, and assuming the disguise of an aged crone, addressed himself to Friga with flattering comments on Balder's courage and good fortune.

The goddess replied that nothing would injure him, since all the products of nature, and all the elements—save, indeed, one insignificant plant, which was obviously powerless—had taken an oath to refrain from inflicting any hurt upon her glorious son. What might be the name of that insignificant plant? inquired the curious Loke.

A feeble little shoot, the mistletoe, said Friga, which grew upon the oak, and was utterly contemptible. Away went the traitorous Loke, obtained some mistletoe, and entering the council-hall of the gods, said to the blind Heda, "Why do you not contend with the arrows of Balder?" Heda

DRUID CUTTING MISTLETOE.

answered, "I am blind, and I have no weapons." Loke handed to him an arrow fashioned out of the mistletoe, and said, "Shoot, shoot; for Balder is in front of thee." Heda obeyed, and Balder fell to the ground transfixed, and slain.

In our sea-side walks, when the tide has ebbed, it is not unusual for us to see numerous crabs half-sunk in the sand devouring one another. The crustacean underneath serves as "a pasture-ground" for the more fortunate animal astride of it, while the latter is simultaneously pulled to pieces by a third. This strange picture of life and death is prosecuted among all organized beings, from man to the lowest forms of algæ.

Most frequently, says Bocquillon, it is a creature regarded as of comparatively imperfect organization which lives at the expense of those of more complex structure. Thus, man nourishes many kinds of protozoa, worms, acarides, insects; our fruit-trees and culinary plants, various species of fungi.

The production known as *Ergot of Rye*—a disease which, in countries where rye-bread is the staple of life, frequently produces the most alarming distress—is due to the growth of a fungus called *Spermadia clavus*, which converts the seed-vessel of the grain into a cylindrical excrescence, destroying all its nutritious part, and rendering it actually poisonous. When rye is extensively cultivated, says a writer, grains thus diseased frequently compose a considerable part of the bread produced, and originate one of the most lamentable and painful diseases which human flesh is heir to. Those who live upon it are afflicted with general weakness, with a feeling as if insects were creeping over the skin. Then the extremities grow cold and become insensible; next, the most agonizing pains are experienced; and lastly, dry gangrene ensues, and the fingers and toes drop off.

Various diseases and diseased conditions are due to the parasitical action of fungi: as dry-rot to the presence of

Merulius lacrymans, and *Polyporus destructor;* the disease called mascondine, in the silk-worm, to *Botrytis Bassiana;* the mould on various organic substances, to *Penicillium glaucum*. The terrible potato disease is probably due to the ravages of a minute fungus called *Botrytis infestans;* that of the vine, to the attacks of the grape oidium, or *Oidium Tuckeri*. This fungus does not live in the interior of the plant, but spreads over the surface of the young fruit a network of fine filaments, which absorb its succulent saccharine juices, and reduce it to a hard, dry, wrinkled, and useless husk. Its devastating effects are rightly regarded in France as a national calamity; for a considerable part of the population depend for their support on the produce of the vineyards.

The disease called *smut*, which so frequently affects our corn-fields, is caused by the fungus *Uredo segetum*. The wanderer through a corn-field in July will frequently have his attention directed to certain grayish-black heads fatally conspicuous among the beautiful emerald stalks. Pull one of these, and examine it; you will find each chaffy scale filled with a hard black substance, like "soot agglutinated by moisture." Under a microscope each grain would show itself converted into a multitude of minute round balls, or *sporules*, of a deep brownish-black colour; as many as 4,000,000 existing in a single grain! Mildew, another terrible cereal affliction, is caused by the *Paccinia grancinis;* brent, by the development of *Uredo caries;* and rust, by the action of *Uredo rubigo*.

IX.—CURIOSITIES OF THE VEGETABLE KINGDOM.

> Many a wild waste and tangled wilderness. . . .
> . . . . Meeting banks, whose yellow flowers
> For ever gaze on their own drooping eyes,
> Reflected in the crystal calm.
>
> SHELLEY.

THE giant and monarch of the vegetable world we take to be the famous *Wellingtonia gigantea*, a native of California, where it was discovered in 1852 by a Mr. Dowd. It was first described by Dr. Lindley.* When it has attained its full growth, its dimensions are truly colossal. What does the reader think of a tree 450 feet high—more than twice the height of the Monument of London—which could not find room to rear its branches beneath the dome of St. Paul's—and whose huge trunk measures 116 feet in circumference? It is difficult for the liveliest imagination to realize any adequate conception of such a leviathan. And if such a task be one to tax the fancy, what shall we say of a forest of these verdurous "colossi," stretching over leagues and leagues of densest shade!

And yet such a scene there is at Calaveras, in California,

* It is now scientifically known as the *Sequoia gigantea*, and belongs to an old genus (*Sequoia sempervirens*) of the *Taxodium* family.

where the awe and astonishment of the traveller are excited by the gigantic masses of the Mammoth Tree Grove. They are situated in lat. 38° N. and long. 120° 10′ W., at an elevation above the sea-level of 4370 feet. Within an area of fifty acres are found one hundred and three trees of goodly proportions, twenty of them exceeding seventy-five feet in circumference, and yet these are saplings, not half arrived at the maturity of their tree-hood! The neighbouring squatters will point you out a stump which affords sufficient area for a public

GIGANTIC SEQUOIA OF CALIFORNIA.

meeting, and on which—so runs the record—thirty-two persons danced four sets of cotillions at one time, without coming into chance collision. This stump measures twenty-five feet across, without the bark. It engaged the labour of five men for twenty-two days to fell it, and this was accomplished not with axe or saw, but by boring it off with pump augers. The bark was removed to England, and put up in the Crystal Palace as a visible representation of a mammoth tree. During the conflagration of 1866 it was unfortunately destroyed.

The largest tree now standing has been named, from its immense size, two breast-like protuberances on one side, and the number of small trees of a similar species adjoining, the "Mother of the Forest." It measures in circumference, without the bark,

At the base,	84 feet, or including the bark, 90 feet.
Twenty feet from the ground,	69 feet.
Seventy feet from the ground,	43 feet 6 inches.
One hundred and sixteen feet from the base,	39 feet 6 inches.
Height to the first branch,	137 feet.
Total height,	321 feet.

Figures sometimes give one but a poor idea of magnitude, but let the reader think of a tree which rises to a greater height than pillar or column in Great Britain before it throws off a single branch!

Near this huge tree lies prone upon the ground the majestic bark of the "Father of the Forest," worthy of its title from its superiority in size. It measures in circumference, at the roots, 110 feet. It is 200 feet to the first branch; the whole of which surpassing length is hollow, and forms a tunnel, where a man can walk erect. Its

height, when standing, is computed to have been 435 feet. Three hundred feet from the roots, and where it was broken off by striking against another large tree, it measures eighteen feet in diameter.

Now let us turn our attention to a graceful pair, apparently inclining towards one another, and therefore appropriately named, "The Husband and Wife." These are of the same dimensions—at the base, about 60 feet in circumference; and in height, about 250 feet.

The "Hermit" stands alone in silent grandeur, with a tall shapely trunk shooting upwards like a colossal monument to an elevation of 318 feet, and 60 feet in circumference.

Another giant has been christened "Hercules;" its girth is 95 feet, and its height 312 feet. In the hollow trunk of the "Burnt Tree"—which is prostrate, and hollow from repeated burnings—a person can ride on horseback for sixty feet! It is supposed, when standing, to have been 103 yards high.

A bent, broken, and melancholy-looking tree is the "Old Maid" of this family of Anakim; 261 feet high, and 59 in circumference. It has a suitable companion in the "Old Bachelor," a rough and scathed old trunk, 298 feet in height, and about 60 feet in girth.

The "Siamese Twins," at about 40 feet from the ground, divide into two separate trees, and reach an altitude of 300 feet.

Mr. Hutchings, to whose interesting pages we are indebted for most of these details, speaks of the "Pride of the Forest" as "one of the most beautiful trees of this wonderful grove. It is well-shaped," he says, "straight,

and sound; and, although not quite so large as some of the others, it is, nevertheless, a noble-looking member of the grove; 275 feet in height, and 60 feet in circumference."

The "Mother and Son," standing side by side, form a picturesque couple, and may well rejoice in each other's almost perennial vigour. The former is 315 feet in height, and the latter 302 feet. Unitedly, their circumference is 93 feet.

The "Guardian," a tree of noble aspect, is 312 feet high by 81 feet in circumference. You may contrast it with the "Beauty of the Forest," which soars upward, with stately crest, to the height of 307 feet, while measuring round the trunk five and sixty feet.

There are also the "Two Guardsmen," 300 feet high; the "Horseback Ride," a hollow and prostrate trunk, 150 feet long; "Uncle Tom's Cabin," 305 feet high, and 91 feet in circumference; and the beautiful group of the "Three Graces," which, together, measure 92 feet in circumference at their base, and are each nearly equal in height, or about 295 feet.

It was at first the opinion of the highest botanical authorities that each concentric circle of the trunk, or about two inches in diameter, was the growth of one year; and as nearly three thousand concentric circles, it was supposed, might be counted in the trunks of the fallen trees, one might reasonably conclude that they were in existence three thousand years ago. Or that they were but fresh green saplings when Rameses the Great was adorning Thebes with architectural marvels; had shot upward, in the glory of their lusty vigour, long before Romulus be-

came the founder of the Roman state; and counted their age by centuries what time the redemption of mankind was accomplished on "the tree of Calvary." But later researches have shown the number of concentric rings to be exaggerated, and that the actual age of the trees is about eleven hundred years.

It was at first supposed that the mammoth grove of Calaveras was the only group of trees of the kind in existence. But in 1855 similar "vegetable wonders" were discovered at Mariposa, and in the neighbourhood of the sources of the Frezno. In the Mariposa wood, one large stem, whose top has been stripped of its branches, bears the poetical name of "Satan's Spear," in allusion to Milton's well-known comparison—

> "To equal which, the tallest pine
> Hewn on Norwegian hills to be the mast
> Of some great ammiral, were but a wand."

Its circumference is 78 feet.

Another huge trunk, with a dilapidated crest, looking strangely like the ruin of some feudal castle, is known as "The Giant's Tower." It is 70 feet in circumference. In close contiguity occur two trees of a very different character; one, shapely and slender, and crowned with a luxuriance of beautiful foliage; the other, a weirdly monster, has a scarred and knotted trunk, with branches all gnarled and broken—these are "Beauty and the Beast." The so-called "Rambler" measures, at its base, 102 feet; from base to top, 250 feet. Two giants, named "The Sisters," are respectively 82 and 87 feet in girth, and each is about 225 feet in height.

The entire group at Mariposa comprises three hundred

trees, covering a triangular area of between four and five hundred acres. About one half of these have been measured by American travellers, from whose report we may select a few items:—

One tree, ... 102 feet in circumference.
One tree, ... 97 feet in circumference.
One tree, ... 92 feet in circumference.
Three trees, ... 76 feet in circumference each.
One tree, ... 72 feet in circumference.
Three trees, ... 70 feet in circumference each.
One tree, ... 68 feet in circumference.
One tree, ... 65 feet in circumference.
One tree, ... 63 feet in circumference.
Three trees, ... 63 feet in circumference each.
Two trees, ... 60 feet in circumference each.
One tree, ... 58 feet in circumference.
And so on, down to 40 feet in circumference.

Some six or seven miles from Mariposa, as the crow flies, is the Frezno grove, consisting of about five hundred trees of the Taxodium family, on about as many acres of undulating forest-land, dense, shadowy, and magnificent. Here the two largest measure 81 feet each in circumference, and the others from 51 to 75 feet.

In no other part of the world, we believe, do the Sequoias attain to such imposing dimensions. The *Sequoia sempervirens*, popularly known as the Red Wood, which extends from Upper California to Nootka Sound, almost rivals its fellow-species, and is frequently found more than 300 feet high. Both kinds have been introduced into England, where, as hardy evergreen trees, they are admired intruders in the garden. But to witness all their majestic beauty, they must be seen in their native habitat, where they stand, like giant warders, to guard the solitude of the long untrodden wilderness.

From a gigantic tree we turn to a colossal flower, which,

of late years, has been the frequent object of public curiosity. All the Lily tribe are "beautifully exceedingly;" but none can compare with the glorious VICTORIA REGIA, which, had it blossomed in fairy-land, would undoubtedly have been hailed as Queen of the Flowers.

The Nymphæaceæ, as they are scientifically denominated, brighten the lakes, streams, and woodland pools of most European countries, and the pale water-lily, nestling its shining blooms on the azure wave, is the eternal

COMMON WATER LILY (*Nymphæa alba*).

favourite of poet and artist; but in tropical climes reach a far more magnificent development. These plants—they are distinguished by their fleshy root-stocks—lie embedded in the ooze at the bottom of their aquatic haunts, while the large, long-stalked, heart-shaped leaves spread themselves like shields on the surface of the water. The flowers have usually four sepals, and numerous petals and stamens. The seeds contain a farinaceous albumen, and are said to possess narcotic and sedative properties. They form an article of diet with some savage races. More than fifty species are known.

The VICTORIA REGIA which is indisputably "the head of

the family," was discovered by Sir Robert Schomburgk, during his travels in Guiana and Demerara. At the close of a summer's day, worn with hunger and fatigue, he rested himself on the rocky bank of the river Berbice, at a point where it had broadened into a sheltered and beauti-

THE VICTORIA REGIA.

ful lake, surrounded by a belt of luxuriant foliage. To his delight and wonder he found its waters covered with this glorious lily, in every stage of development, from the conical brown bud whose opening leaves just disclosed the cream-coloured petals within, to the deep crimson glory of the full-blown flower. There, too, were the wrinkled

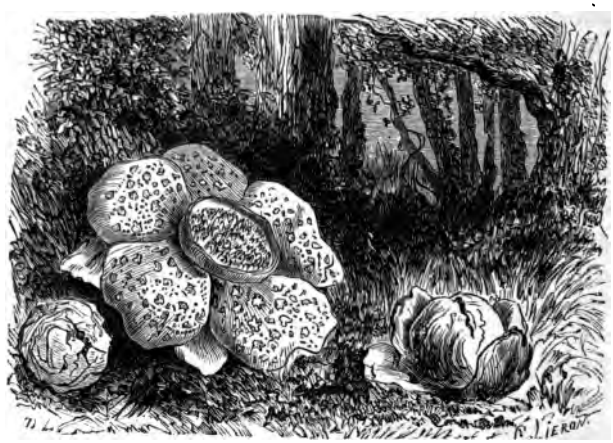
leaves as yet but partially expanded, and there the broad, smooth, emerald shields stretched out upon the tide, of a size and texture to support an infant Puck; some of the flowers, too, glistering like gigantic crowns, and measuring four feet in circumference. He felt rewarded for all his toil by the discovery of a plant so beautiful and so superb, and hitherto unknown to European botanists. In compliment to the British sovereign it was named the *Victoria regia*, and immediately took its place among the rare flowers of the botanic world.

By dint of great care some plants were imported into England. One was placed in the charge of Sir Joseph Paxton, at the Duke of Devonshire's gardens, Chatsworth; and the late architect of the Crystal Palace frequently told the story of the delight with which he and his noble patron, while conversing together in the conservatory specially devoted to it, suddenly beheld its buds unfold and its beautiful petals reveal themselves.

There are now several specimens of the Victoria in the United Kingdom, as in the Botanical Gardens of Glasgow, and especially at Kew. The Victoria house, as it is called, in the latter famous gardens, is always crowded by admiring visitors, who surround, with eager interest, the circular tank, thirty-six feet in diameter, in which the Queen of Flowers displays her splendour.* There, too, are appropriately exhibited several other species of the Nymphæaceæ, as well as the "sacred flower" of India, the enchanted Lotus, whose story we shall hereafter tell, and the Egyptian papyrus.

* The Spaniards call it the "Water Maize." They collect the seeds, and eat them roasted. The fruit is a sort of globular berry, covered with formidable prickles.

If the Victoria regia is remarkable for its magnificence of bloom and blossom, the RAFFLESIA ARNOLDI* is not less remarkable for its grotesqueness of aspect. It reminds us, by its general outline, of some of the wonders of the sea-shore; of those strange and many-hued creatures which may occasionally be seen floating in the translucent deep. Certainly it deserves to be included among the curiosities of the Plant World, for it is nothing but a *flower;* a



RAFFLESIA ARNOLDI.

flower without stalk or leaf, growing upon the roots of various species of *Cissus*, like a fungus on the bark of a forest tree. It belongs to an order, or family, of parasitical plants called Rafflesiaceæ, which, in its turn, is comprised in a class or division known as Rhizantheæ, or Rhizogens. All the Rhizogens are natives of warm climates; two or three species are found in the south of

* Order *Rafflesiaceæ.*

Europe, but the majority flourish in Africa, and in tropical Asia and America. In their general structure they resemble fungi; and they resemble them, too, in their manner of decay; but they have the flowers and sexual characteristics of what are called Phanerogamous * plants.

The Rafflesiaceæ consist wholly of parasitical plants. Their seeds may be compared to a mass of sporules; and each flower is hermaphrodite, or both male and female; the germen, stigma, and pistil being the female, and the stamens the male part.

The flower of the Rafflesia first makes its appearance as a globular, or rather hemispherical swelling of the bark of the Cissus root, and, after the bark has broken, rises up in the form of a large folded cabbage, attaining its full size in about three months. The natives of Sumatra, where it was discovered, call it Krûbut. After it has expanded, it emits a putrid odour, which attracts swarms of flies, like the so-called Carrion flowers, and induces them to deposit their eggs upon it. The cup, or nectary, measures fully three feet in diameter, frequently weighs fifteen pounds, and will hold ten to twelve pints of fluid. It is, therefore, the largest, as well as one of the most singular, of known flowers.

Its colour is a dull red, like brick dust, but relieved by a number of yellowish-white raised spots. The stamens are placed in the centre of the cup, adhering at their base; there are several styles, and the whole flower is invested with scales.

In the year 1818 Sir Stamford Raffles, an adventur-

* *Phanerogamous;* that is, plants in which the essential organs—the stamen and pistil—are conspicuous.

ous traveller and distinguished naturalist, who rendered good service to his country in many arduous capacities, was appointed Governor of Bencoolen, a British settlement in the Island of Sumatra. In his suite was Dr. Arnold, a clever man of science. On one occasion he had accompanied Sir Stamford and Lady Raffles on an excursion into the surrounding country, but straying a little in advance of them, he was suddenly summoned by a Malay servant, who exclaimed, in tones of astonishment, and with gestures of surprise, " Come with me, sir, come! Here is a flower—large, wonderful, beautiful, most wonderful!" Proceeding with the man for about a hundred yards into the jungle, he did indeed descry a strange flower of immense size growing close to the ground, and immediately under the bushes. You may imagine with what delight he pounced upon the treasure. Never did eager child grasp more ardently a longed-for birth-day gift! His first impulse was to cut it off, and carry it away; but finding, on examination, that it had adhered to a small root, he succeeded in detaching the whole, and removing it in safety for further investigation. The flower thus discovered was called *Rafflesia* in compliment to Sir Stamford, and *Arnoldi* in allusion to its discoverer.

There exist two smaller species in Java, another of the great Indian islands. These are the *Rafflesia Patma*, whose flowers, measuring from fifteen to twenty-four inches in diameter, are valued by the Javanese for their medicinal properties as a styptic in cases of excessive bleeding; and the *Rafflesia Horsfieldii*, whose flowers are only three inches broad.

Under the name of LOTUS (Greek, λωτός) the ancients included various plants, mostly belonging to the natural order Nelumbiaceæ, and growing in India and Egypt.

The genus they seem to have had chiefly in view is the *Nelumbium speciosum*, or *Nelumbo;* undoubtedly one of the beauties of the vegetable kingdom, flourishing spontaneously in the still lakes of the Tropics. This plant, which presents a large corolla, tinted with rose and white, was anciently very common in Egypt, but has almost wholly disappeared: a consequence, it is said, of the frequent inundations of the Nile, which have troubled the tranquillity of its watery home, and of too frequent alternations of excessive dryness and humidity. Its rhizomes, or underground stems, furnished the Egyptians with abundant sustenance, easily procured. Diodorus Siculus, an old writer, seems to allude to this plant under the name of *Agrostis*, and the Romans called it the Egyptian bean (*faba Ægyptiaca*). Its celebrity reached the ears of the Greeks, who immediately exercised upon it their fertile fancy; and thus arose the myth of the Lotophagi, or lotus-eaters, which Homer has enshrined in the Odyssey. They were, in sober reality, a peaceful and kindly-natured people, inhabiting a district of Cyrenaica, on the north coast of Africa, and living, to a great extent, on the fruit of the lotus, and a wine which they extracted from it. But, according to the Greek poet, when Ulysses visited them in the course of his wanderings over sea and land, his companions, eating of

> "That enchanted stem
> Laden with flower and fruit,"

forgot their native land, their paternal hearths, and sank into a happy state of dreamy listlessness.

> "And all at once they sang, 'Our island home
> Is far beyond the wave; we will no longer roam.'"

Some naturalists suppose this charmful fruit to be the African jujube;* but the Homeric epithet, "nurse of blossom" (*ἄνθινον εἶδαρ*), seems rather to refer to a shining flower, such as one of the Nymphæaceæ. If there were truth in the legend, how many languid spirits would gladly partake of a root which could lull them into forgetfulness of their duties and responsibilities!

The Egyptians made the lotus, in allusion to its aquatic nature and mode of reproduction, their symbol of fertility and life, and in their religious rites it played an important part. Their god Horus, the divine child, personification of the rising sun, was represented by a lotus springing from the depth of the waters, and the wreath which decorated his breast was composed of the flowers and buds of the same plant.

A similar idea is current among the Hindus, who designate the Nelumbo under the name of Padma, and take it to be their emblem of life and reproduction. The beauty of the flower has led to their associating it with many of their gods. Thus: Vishnu is frequently depicted as reclining on the bosom of the stream, while from his navel issues a colossal lotus plant, and from the lotus plant springs Brahma, the creator of the world. Lakshinî, the Indian Venus or goddess of beauty, is surnamed the "lotus-born," and "the divinity who finds an asylum in the lotus."

* Zizyphus Lotus, Order *Rhamnoceæ*.

The Egyptian lotus, or water-lily, was called by the Egyptians *shnin* or *seshin*, and the Arabs designated it *beshnin*, which is just the Egyptian or Coptic name with the definite article prefixed. It spread its broad white flower on the surface of the Nile and its tributary rivulets, and its root was eaten by the people who inhabited the borders of Lake Menzaleh. The streams and watercourses near

EGYPTIAN LOTUS (*Nelumbium speciosum*).

Damietta were formerly bright with this shining blossom, which rose full two feet above the water. It was the rose of the ancient and mysterious Egypt; the favourite Egyptian flower, which the women loved to weave in their garlands, and bind around their dusky brows. In works of art, such as the prows of boats and the capitals of columns, we find it a constantly-recurring ornament.

In Southern India the Red Lotus is frequently met with. The fable runs, that when Kamadeva (or Cupid) wounded Siva with his arrow, the blood of the latter dropped upon the lily, and changed its hue for evermore. The flower is larger than that of the white water-lily, and Mrs. Graham pronounces it "the most lovely of all the nymphæas."

Moore, in his "Lalla Rookh," has added another to the many poetical associations of this enchanted plant in a charming passage, where he speaks of Cupid, or Love,—

> "As bards have seen him in their dreams
> Down the blue Ganges laughing glide
> Upon a rosy lotus wreath,
> Catching new lustre from the tide
> That with his image shone beneath."

In Cashmere and Persia flourishes the Blue Lotus or blue water-lily,* and the eye of the traveller rests with delight on its starry blossoms

> "When the breeze
> Is making the stream around them tremble!"

But every variety of the water-lily—from the Egyptian lotus, with its wonder-fables, to the beautiful flower that nestles on the calm surface of our English lakes—is exquisitely lovely.

I conclude my facts and fancies respecting all these wonders and beauties with a few notes in reference to the Sensitive Plants,† or Mimosas, which will always be classed among the wonders of the plant-world from that peculiarity of their nature which induces them to shrink and quiver at the lightest touch. When a high wind passes over them, they close their leaves, and fold them,

* Nymphæa cerulea.

† Order *Leguminosæ*, tribe *Cæsalpineæ*, genus *Mimosa*.

as it were, around their stems, as if its cold breath withered their very sap. The excitability is necessarily not so marked as in animals, yet its presence is undeniable, and the effect sufficiently curious.

There are various species of Mimosas; but, in England, *the* sensitive plant *par excellence* is the *Mimosa pudica*, a native of Brazil, which, like many other foreign blossoms, has become naturalized in our English hot-houses. When touched, it droops in humble shame, like a meek spirit; but, after awhile, gathering up its energies, it once more expands its gentle leaflets, as a meek spirit will do if left to recover itself in silence. In fact, the Mimosa reads, for all who have eyes to see, an enduring lesson of humility.

> "Weak with nice sense the chaste mimosa stands,
> From each rude touch withdraws her timid hands;
> Oft as light clouds o'erpass the summer glade,
> Alarmed, she trembles at the moving shade,
> And feels, alive through all her tender form,
> The whispered murmurs of the gathering storm;
> Shuts her sweet eyelids to approaching night,
> And hails with freshened charms the rising light." *

Various theories have been propounded to explain this peculiar effect, but the one most in favour among modern botanists appears to be Dr. Dutrochet's:—

"The principal point of mobility," he says, "exists in the little swelling which is situated at the base of the common and partial petioles (leaf-stalks) of the leaves. This swelling is composed of a very delicate cellular tissue, in which is found an immense number of nervous corpuscules; the axis of the swelling is formed of a little knot of tubular vessels. It was ascertained, by some delicate experiments, that the power of movement, or of con-

* Dr. Darwin, "Loves of the Plants."

traction and expansion, exists in the parenchyma,* or cellular tissue of the swelling, and that the central fibres have no specific action connected with the motion. It also appeared that the energy of the nervous powers of the leaf depended wholly upon an abundance of sap, and that a diminution of that fluid occasioned an extreme diminution of the sensibility of the leaves. Prosecuting his inquiry still further, the author ascertained that in the movements of the sensitive plant there are two distinct motions—the one of locomotion, which results from direct violence offered to the leaves, and occurs in the swellings already spoken of; the other, nervimotion, depending on some stimulus applied to the surface of the leaflets, unaccompanied by actual violence—such as the solar rays concentrated in the focus of a lens. The agency producing this nervimotion is in the ligneous part of the central system, and in certain tubes supplied with nervous corpuscules, and serving for the transmission of the sap."

The *Moving Plant*,† a native of the East Indies, is another interesting member of the same natural order. Its movements differ from those of the mimosa; the leaves having a rotatory, instead of a collapsing or drooping motion. Moreover, the motion is voluntary, for some of the leaflets are never at rest, even when uninfluenced by any external cause. The leaves are ternate, that is, composed of three leaflets; and sometimes one, sometimes two, and even all three of these, will be moving, either steadily or by jerks, in every possible direction.

Sensitive leaves, also, belong to the *Æschynomene visci-*

* From παρὰ, beside or between; and χεῦμα, anything effused or spread out.
† Desmodium gyrans.

dula of Florida, and the *Æschynomene sensitiva* of the West Indies, which open their leaflets during the day and close them at the approach of night; a fact which is likewise noteworthy in the "night-blowing Cereus."

*Venus's Fly-Trap** is a well-known and remarkable example of vegetable irritability. Its native habitat is the North Carolina swamps; but it has been successfully cultivated in our English hot-houses, "solely on account of the interest excited by its peculiar movements." It is a tiny plant, with its leaves arranged in a cluster, out of which the flower-spike springs, and each leaf has long-winged foot-stalks.

But the irritable or sensitive part is the true leaf, which is situated at the apex of the winged petiole; it is divided by a continuation of the mid-rib into two nearly semi-circular lobes, whose edges are fringed with a single row of stiff hairs. Three soft, fine, hair-like bristles occupy the centre of each lobe, on the upper side, and are arranged in the form of a triangle. These are so exquisitely sensitive that the lightest touch will bring the two halves of the leaf together. If, then, a fly, or some other small insect, settle or crawl upon the leaf, and touch the small hairs, the two lobes immediately collapse, "completely and securely enclosing the intruder, until he is either dead or has ceased to struggle, when the sides again open and resume their former position." This is "the trap" which has given name to the plant.

The *Sundews*,† of which three species are indigenous to the British Isles, also possess a slight irritable tendency. The genus is a singular one: the leaves are covered with

* Dionæa muscipula; order *Droseraceæ*. † Drosera.

vermilion-tipped, glandular hairs, whose apex exudes a colourless viscid fluid, which attaches itself to the wings of flies or other minute insects, and gradually bends over them. The leaf itself slightly curls inwards, and so retains its prey until dead.

It will thus be seen that the smallest and most insignificant plants possess their peculiar properties, and that in the world of vegetable life there is ample scope for the keenest observation, and for a scrutiny which, as we believe, can only end in the most admiring reverence.

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